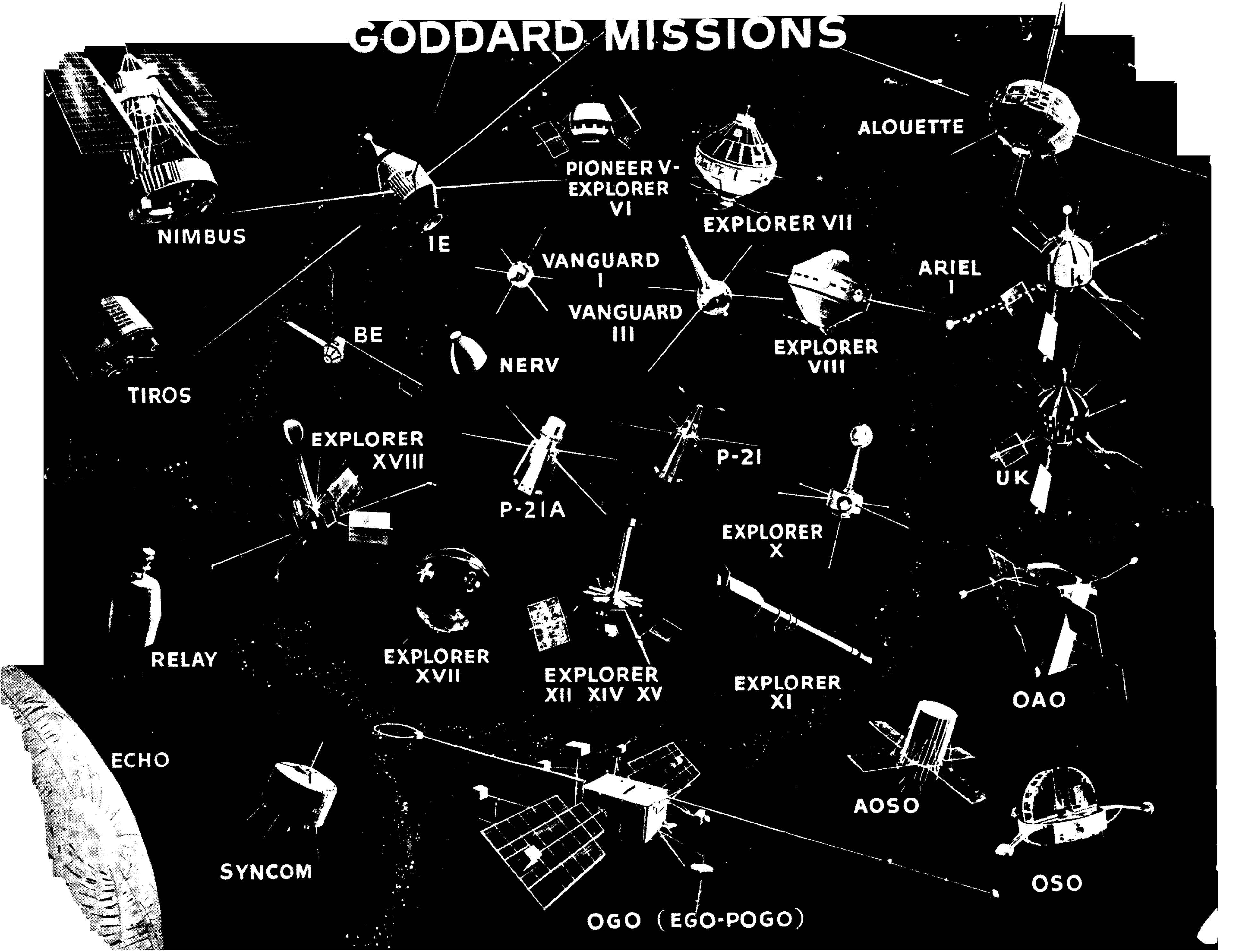
GODDARD PROJECTS SUMMARY

SATELLITES AND SOUNDING ROCKETS

GODDARD SPACE FLIGHT CENTER · NATIONAL AERONAUTICS AND SPACE ADMINISTRATION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P-21
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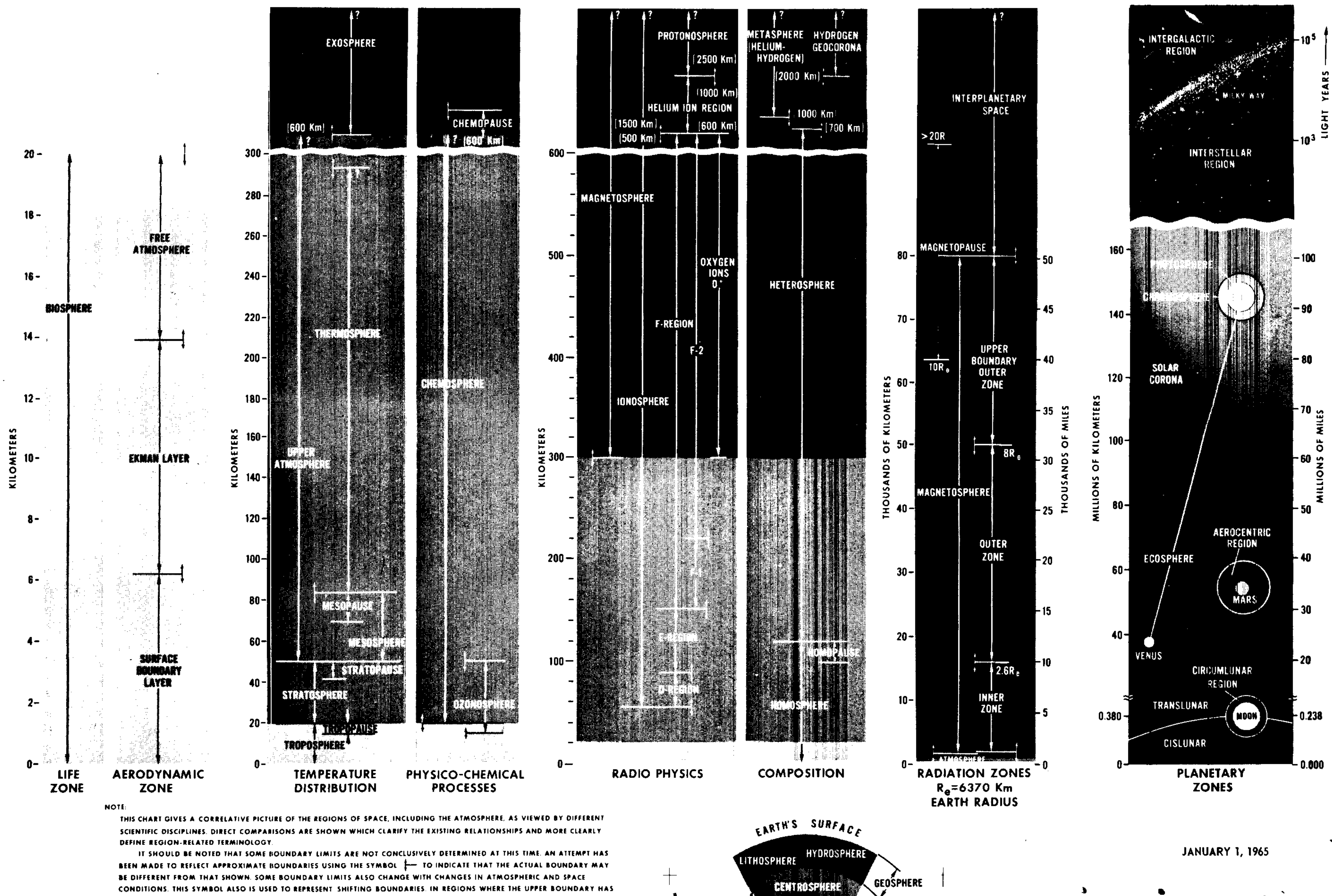
REGIONS OF SPACE VIEWED BY DIFFERENT DISCIPLINES



NOTE:

THIS CHART GIVES A CORRELATIVE PICTURE OF THE REGIONS OF SPACE, INCLUDING THE ATMOSPHERE, AS VIEWED BY DIFFERENT SCIENTIFIC DISCIPLINES. DIRECT COMPARISONS ARE SHOWN WHICH CLARIFY THE EXISTING RELATIONSHIPS AND MORE CLEARLY DEFINE REGION-RELATED TERMINOLOGY.

IT SHOULD BE NOTED THAT SOME BOUNDARY LIMITS ARE NOT CONCLUSIVELY DETERMINED AT THIS TIME. AN ATTEMPT HAS BEEN MADE TO REFLECT APPROXIMATE BOUNDARIES USING THE SYMBOL ├─ TO INDICATE THAT THE ACTUAL BOUNDARY MAY BE DIFFERENT FROM THAT SHOWN. SOME BOUNDARY LIMITS ALSO CHANGE WITH CHANGES IN ATMOSPHERIC AND SPACE CONDITIONS. THIS SYMBOL ALSO IS USED TO REPRESENT SHIFTING BOUNDARIES. IN REGIONS WHERE THE UPPER BOUNDARY HAS NOT BEEN DEFINITELY ESTABLISHED A QUESTION MARK (?) IS SHOWN.

JANUARY 1, 1965

PART I

GODDARD SPACE FLIGHT CENTER SATELLITE AND SPACE PROBE PROJECTS

Designation	Objectives	LAUNCH AND ORBIT DATA: Launch Date/ Silent Date	Vehicle & Launch Site	Period (Min.)	Statute Miles: Perigee	Statute Miles: Apogee	Project Manager and Project Scientist	EXPERIMENT DATA: Instrumentation Summary	Experiment and Discipline*	Experimenter	Affiliation	Remarks
EXPLORER VI 1959 Delta 1 S-2	To measure three specific radiation levels of earth's radiation belts; test scanning equipment for earth's cloud cover; map earth's magnetic field; measure micrometeorites; study behavior of radiowaves.	Aug. 7, 1959 Oct. 6, 1959	Thor-Able ETR	12-½ hours	156	27,357	Dr. John C. Lindsay Dr. John C. Lindsay	Equipment to measure radiation levels; TV-type scanner; micrometeorite detector; two types of magnetometers and devices for space communication experiments.	Triple coincidence telescopes–A Scintillation counter–E Ionization chamber Geiger counter–E Spin-coil magnetometer–E Fluxgate magnetometer–E Aspect sensor Image-scanning television system Micrometeorite detector–P	J. A. Simpson C. Y. Fan P. Meyer T. A. Farley Allen Rosen C. P. Sonnett J. Winckler E. J. Smith D. L. Judge P. J. Coleman	U. of Chicago TRW/STL U. of Minnesota TRW/STL TRW/STL TRW/STL TRW/STL AFCRL TWR/STL	Orbit achieved. All experiments performed. First complete televised cloud-cover picture was obtained. Detected large ring of electrical current circling earth; first detailed study of region now known as the Van Allen radiation belt. Weight: 142 lb. Power: Solar
VANGUARD III 1959 Eta	To measure the earth's magnetic field, X-radiation from the sun, and several aspects of the space environment through which the satellite travels.	Sep. 18, 1959 Dec. 12, 1959	Vanguard ETR	130	319	2329		Proton precisional magnetometer, ionization chambers for solar X-rays, micrometeorite detectors and thermistors.	Proton magnetometer–E Ionization chambers–E Environmental measurements	J. P. Heppner H. Friedman H. E. LaGow	GSFC NRL GSFC	Orbit achieved. Provided comprehensive survey of earth's magnetic field over area covered; surveyed location of lower edge of Van Allen radiation belt. Accurate count of micrometeorite impacts. Power: Solar
EXPLORER VII 1959 Iota 1 S-1a	Variety of experiments, including solar ultraviolet; X-ray; cosmic-ray; earth radiation, and micrometeor experiments.	Oct. 13, 1959 Aug. 24, 1961	Juno II ETR	101.33	342	680	H.E. LaGow	Sensors for measurements of earth-sun heat balance; Lyman-alpha and X-ray solar radiation detectors; micrometeorite detectors, Geiger-Mueller tubes for cosmic ray count; ionization chamber for heavy cosmic rays.	Thermal radiation balance Solar X-ray and Lyman-alpha–S Heavy cosmic radiation–E Radiation and solar-proton observation–E Ground-based ionospheric observations–I	V. Suomi H. Friedman R. W. Kreplin T. Chubb G. Groetzinger P. Schwed M. Pomerantz J. Van Allen G. Ludwig H. Whelpley G. Swenson C. Little G. Reid O. Villard, Jr. W. Ross	U. of Wisconsin NRL Martin Co. Bartol Research St. U. of Iowa U. of Illinois Nat. Bu. of Standards U. of Alaska Stanford U. Penn State U.	Orbit achieved. Provided significant geophysical information on radiation and magnetic storms; demonstrated method of controlling internal temperatures; first micrometeorite penetration of a sensor in flight. Weight: 91.5 lb. Power: Solar

ABBREVIATIONS:

AFCRL	Air Force Cambridge Research Lab.
ARC	Ames Research Center
BTL	Bell Telephone Labs.
CRPL	Central Radio Propagation Lab.
DRTE	Defense Research Telecommunications Establishment
DSIR	Department of Scientific and Industrial Research
ETR	Cape Kennedy
GSFC	Goddard Space Flight Center
JPL	Jet Propulsion Lab.
MIT	Massachusetts Institute of Technology
NRC	National Research Council
NRL	Naval Research Labs.
TRW/STL	Thompson-Ramo-Wooldridge/Space Technology Labs.
WTR	Vandenburg Air Force Base

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GODDARD SPACE FLIGHT CENTER SATELLITE AND SPACE PROBE PROJECTS (Cont.)

Designation	Objectives	LAUNCH AND ORBIT DATA					Project Manager and Project Scientist	EXPERIMENT DATA				Remarks
		Launch Date/ Silent Date	Vehicle & Launch Site	Period (Min.)	Statute Miles Perigee	Statute Miles Apogee		Instrumentation Summary	Experiment and Discipline*	Experimenter	Affiliation	
S-1a (Continued)									Micrometeorite penetration–P	W. Dyke H. LaGow	Linfield Res. Inst. GSFC	
PIONEER V 1960 Alpha	To investigate interplanetary space between orbits of earth and Venus, test extreme long-range communications, study methods for measuring astronomical distances.	Mar. 11, 1960 June 26, 1960	Thor-Able ETR	311.6 days	Perihelion 74.9 million from sun	Aphelion 92.3 million from sun	Dr. John C. Lindsay Dr. John C. Lindsay	High-intensity radiation counter, ionization chamber Geiger-Mueller tube to measure plasmas, cosmic radiation, and charged solar particles. Magnetometer and micrometeorite temperature measurements.	Triple coincidence proportional counter cosmic-ray telescope–E Search-coil magnetometer and photo-electric cell aspect indicator–E Ionization chamber and G-M tube–E Micrometeorite counter–P	J. Simpson D. Judge J. Winckler E. Manring	U. of Chicago TRW/STL U. of Minnesota AFCRL	Highly successful exploration of interplanetary space between orbits of earth and Venus; established communication record of 22.5 million miles on June 26, 1960; made measurements of solar flare effects, particle energies and distribution, and magnetic-field phenomena in interplanetary space. Weight: 94.8 lb. Power: Solar
TIROS I Beta 1960 A-1	To test of experimental television techniques leading to eventual worldwide meteorological information system.	April 1, 1960 June 16, 1960	Thor-Able ETR	99.1	428.7	465.9	W. G. Stroud H. I. Butler	One wide and one narrow angle camera, each with tape recorder for remote operation. Picture data can be stored on tape or transmitted directly to ground stations.	TV camera systems (2)			Provided first global cloud-cover photographs (22,952 total) from near-circular orbit. Weight: 270 lb. Power: Solar
ECHO I 1960 Iota	To place 100-foot inflatable sphere into orbit; measure reflective characteristics of sphere and propagation; study effects of space environment.	Aug. 12, 1960 Passive satellite	Thor-Delta ETR	118.3	945	1049	R. J. Mackey	Two tracking beacons 107.94 Mc and 107.97 Mc	Communications	JPL BTL NRL		Demonstrated use of radio reflector for global communications; numerous successful transmissions. Visible to the naked eye. Orbit characteristics perturbed by solar pressure due to high area-to-mass ratio. Still in orbit. Weight: 132 lb. (including inflation powder) Power: Passive
EXPLORER VIII 1960 Xi S-30	To investigate the ionosphere by direct measurement of positive ion and electron composition; collect data on the frequency, momentum, and energy of micrometeorite	Nov. 3, 1960 Dec. 28, 1960	Juno II ETR	112.7	258	1423	Robert E. Bourdeau Robert E. Bourdeau	RF-impedance probe using a 20-foot dipole sensor; single-grid ion trap; four multiple-grid ion traps; Langmuir probe experiment, rotating shutter electric field meter; micro plier;	RF impedance–I Ion traps–I	J. Cain R. Bourdeau G. Serbu E. Whipple J. Donley	GSFC GSFC	The micrometeorite influx rate was measured. Weight: 90.14 lb. Power: Battery

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Designation	Objectives	LAUNCH AND ORBIT DATA					Project Manager and Project Scientist	EXPERIMENT DATA				Remarks
		Launch Date/ Silent Date	Vehicle & Launch Site	Period (Min.)	Statute Miles Perigee	Statute Miles Apogee		Instrumentation Summary	Experiment and Discipline*	Experimenter	Affiliation	
EXPLORER VIII (Continued)	impacts; establish the attitude of the base of the exosphere.							micrometeorite microphone; thermistors for reading internal and surface temperatures of the spacecraft, and despin mechanisms to reduce spin from 450 to 30 rpm.	Langmuir probe–I Rotating-shutter electric field meter–I Micrometeorite photomultiplier–I Micrometeorite microphone–I	R. Bourdeau G. Serbu E. Whipple J. Donley J. Donley M. Alexander C. McCracken O. Berg M. Alexander C. McCracken	GSFC GSFC GSFC GSFC	
TIROS II 1960 Pi I A-2	To test experimental television techniques and infrared equipment leading to eventual world-wide meteorological information system.	Nov. 23, 1960 July 12, 1961	Delta ETR	98.2	406	431	Dr. R. A. Stampfl	Included one wide-angle and one narrow-angle camera, each with tape recorder for remote operation; infrared sensors to map radiation in various spectral bands; attitude sensors; experimental magnetic orientation control.	Two TV camera systems Widefield radiometer Scanning radiometer	W. Nordberg R. Hanel	GSFC GSFC	Orbit achieved. Narrow-angle camera and IR instrumentation sent good data. Transmitted 36,156 pictures. Still operative. Weight: 277 lb. Power: Solar
EXPLORER IX 1961 Delta I S-56a (A project of the Langley Research Center with GSFC participation)	To study performance, structural integrity, and environmental conditions of Scout research vehicle and guidance controls system. Inject inflatable sphere into earth orbit to determine density of atmosphere.	Feb. 16, 1961 Passive satellite	Scout Wallops Island	118.3	395	1605		Radio beacon on balloon and in fourth stage.				Vehicle functioned as planned. Balloon and fourth stage achieved orbit. Transmitter on balloon failed to function properly requiring optical tracking of balloon. Weight: 80 lb. Power: Passive
EXPLORER X 1961 Kappa P-14	To gather definite information on earth and interplanetary magnetic fields and the way these fields effect and are affected by solar plasma.	March 25, 1961 March 27, 1961	Thor-Delta ETR	112 hours	100	186,000	Dr. J. P. Heppner Dr. J. P. Heppner	Included rubidium vapor magnetometer, two flux-gate magnetometers, a plasma probe, and an optical aspect sensor.	Rubidium-vapor magnetometer and flux-gate magnetometers–E Plasma probe–E Spacecraft attitude	J. P. Heppner T. L. Skillman C. S. Scearce H. Bridge F. Scherb B. Rossi J. Albus	GSFC MIT GSFC	Probe transmitted valuable data continuously for 52 hours as planned. Demonstrated the existence of a geomagnetic cavity in the solar wind and the existence of solar proton streams transporting solar interplanetary magnetic fields past the earth's orbit. Weight: 79 lb. Power: Battery

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Designation	Objectives	LAUNCH AND ORBIT DATA					Project Manager and Project Scientist	EXPERIMENT DATA				Remarks
		Launch Date/ Silent Date	Vehicle & Launch Site	Period (Min.)	Statute Miles			Instrumentation Summary	Experiment and Discipline*	Experimenter	Affiliation	
					Perigee	Apogee						
EXPLORER XI 1961 Nu 1 S-15	To orbit a gamma-ray astronomy telescope satellite to detect high-energy gamma rays from cosmic sources and map their distribution in the sky.	April 27, 1961 Dec. 6, 1961	Juno II ETR	108.1	308	1113.2	Dr. J. Kupperian, Jr. Dr. J. Kupperian, Jr.	Gamma-ray telescope consisting of a plastic scintillator, crystal layers, and a Cerenkov detector; sun and earth sensors; micrometeorite shields; temperature sensor; damping mechanism.	Gamma-ray telescope—E	W. Kraushaar G. Clark	MIT	Orbit achieved. Detected first gamma rays from space. Directional flux obtained. Disproved one part of "steady-state" evolution theory. Weight: 82 lb. Power: Solar
TIROS III 1961 Rho 1 A-3	To develop satellite weather observation system; obtain photos of earth's cloud cover for weather analysis; determine amount of solar energy absorbed, reflected and emitted by the earth.	July 12, 1961 Feb. 1962	Delta ETR	100.4	461.02	506.44	Robert Rados	Two wide-angle cameras, two tape recorders and electronic clocks, infrared sensors, five transmitters, attitude sensors, magnetic attitude coil.	Omnidirectional radiometer Widefield radiometer Scanning radiometer Two T V Cameras	V. Suomi R. Hanel W. Nordberg	U. of Wisconsin GSFC GSFC	Orbit achieved. Cameras and IR instrumentation transmitted good data. Transmitted 35,033 pictures. Weight: 285 lb. Power: Solar
EXPLORER XII ENERGETIC PARTICLES EXPLORER 1961 Upsilon 1	To investigate solar wind, interplanetary magnetic fields, distant portions of earth's magnetic field, energetic particles in interplanetary space and in the Van Allen belts.	Aug. 15, 1961 Dec. 6, 1961	Thor-Delta ETR	26.45 hours	180	47,800	Paul Butler Dr. F. B. McDonald	Ten particle detection systems for measurement of protons and electrons and three orthogonally mounted fluxgate sensors for correlation with the magnetic fields, optical aspect sensor, and one transmitter. PFM telemetry transmitting continuously.	Two mass spectrometers—P Four vacuum (pressure) gauges—P Two electrostatic probes—I	C. Reber R. Horowitz G. Newton N. Spencer L. Brace	GSFC GSFC GSFC	Orbit achieved. All instrumentation operated normally. Ceased transmitting on Dec. 6, 1961, after sending 2568 hours of real-time data. Provided significant geophysical data on radiation and magnetic fields. Weight: 83 lb. Power: Solar
EXPLORER XIII 1961 Chi 1 (A project of the Langley Research Center with GSFC participation)	To test performance of the vehicle and guidance; to investigate nature and effects on space f flight of micrometeoroids.	Aug. 25, 1961 Aug. 27, 1961	Scout Wallops Island	97.5	74	722	C. T. D'Aiutolo	Micrometeoroids impact detectors; transmitters.	Cadmium sulphide photoconductor—A Wire grid	M. W. Alexander L. Secretan	GSFC	Orbit was lower than planned. Reentered August 27, 1961. Weight: 187 lb. including 50-lb. 4th stage and 12-lb. transition section. Power: Solar
P-21 ELECTRON DENSITY PROFILE PROBE P-21	To measure electron densities and to investigate radio propagation at 12.3 and 73.6 Mc under daytime conditions.	Oct. 19, 1961 Oct. 19, 1961	Scout Wallops Island				John E. Jackson Dr. S. J. Bauer	Continuous-wave propagation experiment for the ascent portion of the trajectory, and an RF-probe technique for the descent.	RF probe—I CW propagation—I	H. Whale G. H. Spaid J. E. Jackson	GSFC GSFC GSFC	Probe achieved altitude of 4261 miles and transmitted good data. Electron density was obtained to about 1500 miles, the first time such measurements had been taken at this altitude.

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Designation	Objectives	LAUNCH AND ORBIT DATA: Launch Date/ Silent Date	Vehicle & Launch Site	Period (Min.)	Statute Miles: Perigee	Apogee	Project Manager and Project Scientist	EXPERIMENT DATA: Instrumentation Summary	Experiment and Discipline*	Experimenter	Affiliation	Remarks
P-21 (Continued)												Weight: 94 lb. Power: Battery
TIROS IV 1962 Beta A-9	To develop principles of a weather satellite system; obtain cloud and radiation data for use in meteorology.	Feb. 8, 1962 June 19, 1962	Delta ETR	100.4	471	525	Robert Rados	Two TV camera systems with clocks and recorders for remote pictures, infrared sensors, heat budget sensors, magnetic orientation control horizon sensor, north indicator.	Omnidirectional radiometer Widefield radiometer Scanning radiometer Two TV camera systems	V. Suomi R. Hanel W. Nordberg	U. of Wisconsin GSFC GSFC	Orbit achieved. All systems operated properly. Tegea Kinoptic lens used on one camera, Elgeet lens on the other. Supported Project Mercury. Weight: 285 lb. Power: Solar
ORBITING SOLAR OBSERVATORY 1962 Zeta OSO-1	To measure solar electromagnetic radiation in the ultraviolet, X-ray and gamma-ray regions; to investigate effect of dust particles on surfaces of spacecraft.	March 7, 1962 Aug. 6, 1963	Delta ETR	96.15	343.5	369	Dr. John C. Lindsay Dr. John C. Lindsay	Devices to conduct 13 different experiments for study of solar electro-magnetic radiations; investigate dust particles in space and thermoradiation characteristics of spacecraft surface materials.	X-ray spectrometer–S 0.510 Mev gamma-ray monitoring; 20-100 kev X-ray monitoring; 1-8A X-ray monitoring–S Dust particle – E Solar radiation and solar ultraviolet – A Solar gamma rays, high-energy distribution–A Solar gamma rays, low-energy distribution–A Solar gamma rays, high-energy distribution–A Neutron monitor – E Lower Van Allen belt–E Emissivity stability of surfaces in a vacuum environment–E	W. Behring, W. Neupert K. Frost, W. White M. Alexander, C. McCracken W. White, K. Hallam W. White, K. Frost J. R. Winkler, L. Peterson M. Savedoff, G. Fazio W. Hess S. Bloom G. Robinson	GSFC GSFC GSFC GSFC GSFC U. of Minnesota U. of Rochester U. of California U. of California ARC	Orbit achieved. Experiments transmitted as programmed. Weight: 458 lb. Power: Solar
P21A ELECTRON DENSITY PROFILE PROBE	To measure electron density profile, ion density, and intensity of ions in the atmosphere.	March 29, 1962 March 29, 1962	Scout Wallops Island				John E. Jackson Dr. S. J. Bauer	A continuous-wave propagation experiment to determine electron density and associated parameters of ionosphere. A swept-frequency probe for direct measurements of electron density and a positive ion experiment to determine ion concentration under nighttime conditions.	CW propagation–I RF probe–I Ion traps–I	S. Bauer H. White R. Bourdeau, E. Whipple, J. Donley, G. Serbu	GSFC GSFC GSFC	Probe achieved altitude of 3910 miles. Afforded nighttime observations. Determined that characteristics of the ionosphere differ drastically from daytime state when the temperature of the ionosphere is much cooler. (See P-21) Weight: 94 lb. Power: Battery

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Designation	Objectives	LAUNCH AND ORBIT DATA					Project Manager and Project Scientist	EXPERIMENT DATA				Remarks
		Launch Date/ Silent Date	Vehicle & Launch Site	Period (Min.)	Statute Miles			Instrumentation Summary	Experiment and Discipline*	Experimenter	Affiliation	
					Perigee	Apogee						
ARIEL 1 INTERNATIONAL SATELLITE 1962 Omicron 1 (UK-1)	To study relationship between ionosphere and cosmic rays.	April 26, 1962 Active (see remarks)	Delta ETR	100.9	242.1	754.2	R. C. Baumann Robert E. Bourdeau	Electron density sensor, electron temperature gauge, solar aspect sensor, cosmic ray detector, ion mass sphere, Lyman-alpha gauges, tape recorder, X-ray sensors.	Electron density sensor–I Electron temperature gauge–I Cosmic-ray detector–E Ion mass sphere–I Lyman-alpha gauge–I X-ray emission–I	J. Sayers R. L. F. Boyd H. Elliot R. L. F. Boyd R. L. F. Boyd R. L. F. Boyd	U. of Birmingham, (U.K.) U. College, London (U.K.) Imperial College, London (U.K.) U. College, London (U.K.) U. College, London (U.K.) U. College, London (U.K.)	Orbit achieved. First international satellite. Contained six British experiments launched by American Delta vehicle. All experiments except Lyman-alpha transmitted as programmed. Lyman-alpha gauge failed during launch, ion mass sphere, Sept. 1962; X-ray emission, Oct. 1962; cosmic-ray detector, Dec. 1962, and electron density sensor, Mar. 1963. Tracking and data acquisition stopped on request of the project on June 30, 1964. Restarted on Aug. 25, 1964 for a 2-month period. Good data is being acquired from electron temperature gauge.
TIROS V 1962 Alpha Alpha 1 A-50	To develop principles of a weather satellite system; obtain cloud-cover data for use in meteorology.	July 19, 1962 May 4, 1963	Delta ETR	100.5	367	604	Robert Rados	Two TV camera systems with tape recorders for recording remote picture areas, magnetic orientation control, horizon sensor, north indicator.	Two TV camera systems			Launched at a higher inclination (58°) than previous TIROS satellites, to provide greater coverage. Time of launch chosen to include normal hurricane season for South Atlantic. One TV system transmitted good data for 10½ months. Weight: 285 lb. Power: Solar
TELSTAR NO. 1 (A project of AT&T) 1962 Alpha Epsilon 1	Joint AT&T–NASA investigation of wideband communications.	July 10, 1962 Feb. 21, 1963	Delta ETR	157.8	592.6	3503.2	C. P. Smith, Jr.	The system provided TV, radio, telephone and data transmission via a satellite repeater system.	Included electron detector for range 250,000-1 Mev; proton detectors in the following energy ranges 2.5-25.0 Mev, ranges greater than 50 Mev	W. Brown	BTL	Orbit achieved. Television and voice transmissions were made with complete success. BTL provided spacecraft and ground stations facilities. Government was reimbursed for cost incurred. Conducted more than 300 technical tests and over 400

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Designation	Objectives	Launch Date/ Silent Date	Vehicle & Launch Site	Period (Min.)	Statute Miles Perigee	Statute Miles Apogee	Project Manager and Project Scientist	Instrumentation Summary	Experiment and Discipline*	Experimenter	Affiliation	Remarks
TELSTAR NO. 1 (Continued)												demonstrations; 50 TV programs–5 in color. Weight: 175 lb. Power: Solar
TIROS VI 1962 Alpha Psi 1 A-51	To study cloud cover and earth heat balance; measurement of radiation in selected spectral regions as part of a program to develop meteorological satellite systems.	Sep. 18, 1962 Oct. 11, 1963	Delta ETR	98.73	425	442	Robert Rados	Two TV camera systems (78° and 104° lens), clocks and tape recorders for remote operation, infrared and attitude sensors, magnetic-attitude coil.	Two TV camera systems			Inclination 58.3°; velocity at perigee 16,822; apogee, 16,756. Medium-angle camera failed Dec. 1, 1962 after taking 1074 pictures. TV camera provided good data for 13 months after launch. Weight: 300 lb. Power: Solar
ALOUETTE I SWEPT FREQUENCY TOPSIDE SOUNDER (Canada) 1962 Beta Alpha 1	To measure the electron density distribution in the ionosphere between the satellite height (620 miles) and the F2 peak (approx. 180 miles) and to study for a period of 1 year the variations of electron density distribution with time of day and with latitude under varying magnetic and auroral conditions with particular emphasis on high-latitude effects. To obtain galactic-noise measurements, study the flux of energetic particles, and investigate whistlers.	Sep. 29, 1962	Thor-Agena WTR	105.4	620	638	John E. Jackson	The satellite was spin-stabilized and contained a swept-frequency pulse sounder covering the frequency range 0.5 to 11.5 Mc. Sounder data was transmitted via a 2-watt FM telemetry system. Data from the other experiments and housekeeping data was transmitted through a ¼-watt PM-telemetry system. There were two sets of sounder antennas, the longest set measuring 150 ft. tip to tip. Data was acquired on command and in real time only.	Topside sounder–I Energetic particle counters–E VLF receiver (whistler)–I Cosmic noise–A	E. S. Warren G. L. B. Nelms G. E. Lockwood E. L. Hagg L. E. Petrie D. B. Muldrew R. W. Knecht T. E. Van Zandt W. Calvert J. W. King S. J. Bauer L. Blumle R. Fitzenreiter J. E. Jackson D. C. Rose I. B. McDiarmid J. S. Belrose T. R. Hartz	DRTE CRPL NBS DSIR England GSFC NRC Canada DRTE DRTE	The Alouette satellite is a project of the Canadian Defence Research Board. This international project is a part of NASA's topside sounder program and was the first NASA-launched satellite from the WTR. Alouette has the distinction of being the first spacecraft designed and built by any country other than the U.S. and the USSR. After almost 2 years in orbit, the satellite has experienced no failures and its operation was nominal. Weight: 320 lb. Power: Solar
EXPLORER XIV ENERGETIC PARTICLES SATELLITE 1962 Beta Gamma 1 EPE-B	To correlate energetic particles activity with observations of the earth's magnetic fields; to monitor the existence of transient magnetic fields associated with plasma streams.	Oct. 2, 1962 Feb. 1964	Delta ETR	36.58 hours	184	54,123	Paul G. Marcotte Dr. F. B. McDonald	A low-energy (0.1 to 20 kev) proton analyzer; a three-core magnetometer; one omnidirectional and three directional electron-proton detectors; a three-basic unit cosmic-ray package; an ion-electron scintillation detector; and devices to determine the	Proton analyzer–E Magnetic field (magnetometer)–E Trapped-particle radiation–E Cosmic-ray, ion-electron detector, solar-cell, and electrolytic timer–E	M. Bader L. Cahill J. A. Van Allen B. J. O'Brien F. B. McDonald L. R. Davis U. Desai	ARC U. of New Hampshire State U. of Iowa GSFC	Velocity at apogee 1507 mph; perigee 23,734 mph. Inclination to equator 33°. Weight: 89.25 lb. Power: Solar

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EXPLORER XIV (Continued)								effects of radiation on solar cells and the effects of space on electrolytic timers.				
EXPLORER XV	To study artificial radiation belt created by nuclear explosion.	Oct. 27, 1962 Feb. 9, 1963	Delta ETR	5 hours (C. 315 min.)	195	10,950	Dr. John W. Townsend Dr. Wilmot Hess	Similar to Explorer XII.	Electron energy distribution–I Omnidirectional detector–I Angular distributor–E Directional detector–I Ion-electron detector–E Magnetic field–E Solar cell damage–I	W. Brown U. Desai C. McIlwain W. Brown C. McIlwain L. Davis L. Cahill H. K. Gummel	BTL GSFC U. of California BTL U. of California GSFC U. of New Hampshire BTL	Good data received on artificial radiation belt. Weight: 100 lb. Power: Solar
RELAY I 1962 B Upsilon 1	To investigate wideband communications between ground stations by means of low-altitude orbiting spacecraft. Communications signal to be evaluated will be an assortment of TV signals, multichannel telephony, and other communications. To measure the effects of the space environment on the system; to include radiation damage to solar cells and radiation flux density. To provide tests and demonstrations of low-altitude communications satellite.	Dec. 13, 1962	Delta ETR	185.09	819.64	4612.18	Wendell Sunderlin Dr. Ramond Waddel	The spacecraft contained an active communications repeater to receive and retransmit communications between the U.S. and Europe, U.S. and South America, U.S. and Japan, and Europe and South America; and an experiment to assess radiation damage to solar cells, and to measure proton and electron energy.	Determine radiation damage to solar cells and semiconductor diodes–E Measure proton energy (2.5-25.0 Mev)–E Measure electron energy (1.25-2.0 Mev)–E Measure integral omnidirectional proton flux energy (35.0-300.0 Mev)–E Measure directional electron energy (0.5-1.2 Mev)–E Measure directional proton energy (15.0-60.0 Mev)–E Measure directional proton energy (1.0-8.0 Mev)–E	R. Waddel W. Brown W. Brown C. McIlwain C. McIlwain C. McIlwain C. McIlwain	GSFC BTL BTL U. of California U. of California U. of California U. of California	Orbit achieved. TV, telephone, teletype, facsimile, and digital-data transmissions were made with very satisfactory results. Conducted more than 2000 technical tests and 172 successful demonstrations. Weight: 172 lb. Power: Solar
SYNCOM 1 1963 4A A-25	To provide experience in using communications satellites in a 24-hour orbit. To flight-test a new, simple approach to satellite attitude and period control. To develop transportable ground facilities to be used in conjunction with communications satellites. To develop capability of launching satellites	Feb. 14, 1963 Feb. 14, 1963	Delta ETR	24 hours	Near-synchronous orbit	22,300	R. J. Darcey	The 24-hour communications satellite consists of a spin-stabilized active repeater in a near-synchronous low-inclination orbit. The spacecraft is in the form of a cylinder 28 inches in diameter and 15 inches high. The repeater consists of a 7200-Mc receiver and an 1800-Mc transmitter with an output of 2 watts. In addition, the spacecraft contains				Twenty seconds after firing apogee rocket, all satellite transmissions stopped. The satellite was sighted on Feb. 28, 1963 and later dates. It was travelling in a near-synchronous orbit eastward at about 2.8° per day. Weight: 78 lb. Power: Solar

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PART I

GODDARD SPACE FLIGHT CENTER SATELLITES AND SPACE PROBE PROJECTS (Cont.)

Designation	Objectives	LAUNCH AND ORBIT DATA					Project Manager and Project Scientist	EXPERIMENT DATA				Remarks
		Launch Date/ Silent Date	Vehicle & Launch Site	Period (Min.)	Statute Miles: Perigee	Statute Miles: Apogee		Instrumentation Summary	Experiment and Discipline*	Experimenter	Affiliation	
SYNCOM 1 (Continued)	into 24-hour orbit using existing vehicles, plus apogee kick techniques and to test components life at 24-hour-orbit altitude.							a vernier velocity control system for orientation of spin axis and adjustment of the orbit.				
EXPLORER XVII ATMOSPHERE EXPLORER 1963 9A	To measure the density, composition, pressure, and temperature of the earth's atmosphere from 135 to 540 nautical miles and to determine the variations of these parameters with time of day, latitude, and in part, season.	April 2, 1963 July 10, 1963	Delta ETR	96.4	158.1	598.5	N. W. Spencer	Primary detectors to be employed (two each) are: Double focusing magnetic sector mass spectrometer, hot-cathode total-pressure ionization gauges and cold-cathode total-pressure ionization gauges. The remaining satellite instrumentation converts the outputs from six detectors to radio signals.	Two mass spectrometers—P Four vacuum (pressure) gauges—P Two electrostatic probes—I	C. Reber R. Horowitz G. Newton N. Spencer L. Brace	GSFC GSFC GSFC GSFC	Confirmed that the earth is surrounded by a belt of neutral helium at an altitude of from 150 to 600 miles. Weight: 405 lb. Power: Silver zinc batteries
TELSTAR II 1963 13A (A project of AT&T)	Joint AT&T-NASA investigation of wideband communications.	May 7, 1963	Delta ETR	221	575	6559	C. P. Smith, Jr.	The system provides for TV, radio, telephone and data transmission via a satellite repeater system.	Included electron detector for energy range 750,000 to 2 Mev			"Evacuated" transistors in one of the encoders. Weight: 175 lb. Power: Solar
TIROS VII 1963 24A	To launch into orbit a satellite capable of viewing cloud cover, and the earth's surface and atmosphere by means of television cameras and radiation sensors. To acquire and process collected data from satellite and to control its attitude by magnetic means.	June 19, 1963	Delta ETR	97.4	385.02	401.14	Robert Rados	Two vidicon cameras each with a wide-angle lens, five-channel medium-resolution radiometer, electron temperature probe, and magnetic attitude coil.	Omnidirectional radiometer Scanning radiometer Electron temperature experiment	V. Suomi A. McCulloch N. Spencer	U. of Wisconsin GSFC GSFC	TV coverage extended to 65° N and 65° S latitudes. Launch date selected to provide maximum northern hemisphere coverage during 1963 hurricane season. Electron temperature probe malfunction 26 days after launch. First TIROS to have two operational camera systems and fully functioning IR subsystem15 months after launch. Weight: 297 lb. Power: Solar Inclination: 58° to equator
SYNCOM II 1963 31A	To provide experience in using communications satellites in a 24-hour orbit. To flight-test a new, simple approach to satellite attitude and period control. To	July 26, 1963	Delta ETR	24 hours	22,300 near-synchronous orbit		R. J. Darcey	The 24-hour communications satellite consists of a spin-stabilized active repeater in a near-synchronous low-inclination orbit. The spacecraft is in the form of a cylinder 28 inches				Orbit and attitude control of the spin-stabilized synchronous satellite achieved. Data, telephone, and facsimile transmission were excellent.

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GODDARD SPACE FLIGHT CENTER SATELLITES AND SPACE PROBE PROJECTS (Cont.)

Designation	Objectives	LAUNCH AND ORBIT DATA					Project Manager and Project Scientist	EXPERIMENT DATA				Remarks
		Launch Date/ Silent Date	Vehicle & Launch Site	Period (Min.)	Statute Miles Perigee	Statute Miles Apogee		Instrumentation Summary	Experiment and Discipline*	Experimenter	Affiliation	
SYNCOM II (Continued)	develop transportable ground facilities to be used in conjunction with communications satellites. To develop capability of launching satellites into 24-hour orbit using existing vehicles, plus apogee kick techniques and to test components life at 24-hour orbit altitude.							in diameter and 15 inches high. The repeater consists of a 7200-Mc receiver and an 1800-Mc transmitter with an output of 2 watts. In addition, the spacecraft contains a vernier velocity-control system for orientation of spin axis and adjustment of the orbit.				Television video signals also were successfully transmitted, even though the satellite was not designed for this capability. Weight: 70 lb. Power: Solar
EXPLORER XVIII INTERPLANETARY EXPLORER PLATFORM 1963 46A (IMP)	To study in detail the radiation environment of cislunar space and to monitor this region over a significant portion of a solar cycle. To study the quiescent properties of the interplanetary magnetic field and its dynamical relationships with particle fluxes from the sun. To develop a solar flare prediction capability for Apollo. To extend the knowledge of solar-terrestrial relationships. To further the development of simple, inexpensive, spin-stabilized spacecraft for interplanetary investigations.	Nov. 27, 1963	Delta ETR	93 hours	122	121,605	Paul Butler Dr. F. B. McDonald	To carry 10 experiments; essentially a combination of the successful GSFC Explorer X and XII satellites. It is spin-stabilized and powered by solar cells. The system is designed so that data can be received from apogee by the GSFC Minitrack stations.	Plasma-measure thermal ions and electrons 0.10 ev–I	G. P. Serbu R. Bourdeau	GSFC	All experiments and equipment operating satisfactorily except for thermal ion experiment which is giving only 10 percent good data. Continues to provide significant data since launch. First accurate measure of the interplanetary magnetic field, and the shock front. First satellite to survive a severe earth shadow of 7 hr., 55 min. Electronics equipment estimated to have cooled to below -60°C. Weight: 137.5 lb. Power: 38 watts solar
									Magnetic field experiment (fluxgate magnetometer)–E	N. F. Ness	GSFC	
									Measure solar and galactic protons and alpha particles–E	J. A. Simpson	U. of Chicago	
									Measure total ionization produced per unit time in a unit volume of standard density air–E	K. A. Anderson	U. of California	
									Measure flux of low-energy interplanetary plasma–E	H. S. Bridge	MIT	
									Measure solar and galactic protons, electrons, alpha particles, heavy primaries, and isotropy of solar proton events and of cosmic-ray modulation–E	F. McDonald G. Ludwig	GSFC	
									Magnetic field (rubidium-vapor magnetometer)–E	N. F. Ness	GSFC	
									Solar wind proton concentrations–E	John Wolfe	ARC	
TIROS VIII 1963 54A	To launch into orbit a satellite capable of viewing cloud cover and the earth's atmosphere by means of television cameras. To acquire and process collected data from satellite and to control its attitude by magnetic means.	Dec. 21, 1963	Delta ETR	99.35	435.01	468.30	Robert Rados	One standard TIROS vidicon with a wide-angle lens camera system, and one automatic picture transmission camera system; magnetic attitude coil.				This satellite proved for the first time the feasibility of APT (automatic picture transmission) on inexpensive direct facsimile readout. Weight: 265 lb. Power: Solar

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GODDARD SPACE FLIGHT CENTER SATELLITES AND SPACE PROBE PROJECTS (Cont.)

Designation	Objectives	LAUNCH AND ORBIT DATA: Launch Date/ Silent Date	Vehicle & Launch Site	Period (Min.)	Statute Miles: Perigee	Apogee	Project Manager and Project Scientist	EXPERIMENT DATA: Instrumentation Summary	Experiment and Discipline*	Experimenter	Affiliation	Remarks
RELAY II 1964 -3A	To investigate wideband communications between ground stations by means of low-altitude orbiting spacecraft. Communications signal to be evaluated ated will be an assortment of TV signals, multichannel telephony, and other communications. To measure also the effects of the space environment on the system; to include radiation damage to solar cells and radiation flux density. To provide tests and demonstration of low-altitude communications satellite.	Jan. 21, 1964	Delta ETR	194.7	1298	4606	Wendell Sunderlin Dr. Ramond Waddel	The spacecraft contains an active communications repeater to receive and retransmit communications between the U.S. and Europe, U.S. and South America, U.S. and Japan, and Europe and South America; and an experiment to assess radiation damage to solar cells, and to measure proton and electron energy.	Determine radiation damage to solar cells and semiconductor diodes–E Measure proton energy (2.5-25.0 Mev)–E Measure electron energy (0.6-1.6 Mev)–E Measure integral omnidirectional proton flux energy (40.0-300.0 Mev and electrons greater than 5 Mev)–E Measure directional electron energy (0.4-1.2 Mev)–E Measure directional proton energy (18.0-60.0 Mev)–E Measure directional proton energy (1.0-8.0 Mev)–E	R. Waddel W. Brown W. Brown C. McIlwain C. McIlwain C. McIlwain C. McIlwain	GSFC BTL BTL U. of California U. of California U. of California U. of California	Orbit achieved. TV, telephone, teletype facsimile, and digital-data transmissions were made with very satisfactory results. Conducted more than 1500 technical tests and 95 successful demonstrations. Weight: 184 lb. Power: Solar n/p cells
ECHO II Passive Communications Satellite (Rigidized sphere)	To demonstrate a spacecraft deployment and rigidization technique applicable to passive-communications satellites; to advance the state-of-the-art represented by the presently orbiting Echo I satellite; to provide development directly applicable to the accomplishment of the Advanced Passive Communications Satellite Program; to constitute a step toward the development of the technology necessary for establishment of a global passive communications network for civilian use.	Jan. 25, 1964	Thor-Agena B WTR	109	557.9	709.1	Herbert L. Eaker	Two beacon transmitters	Communications Propagation Acquisition and tracking Radar Optical	U.S. Air Force, U.S. Navy United Kingdom Soviet Union, Ohio State University		Weight: 650 lb. Power: Solar Inclination: 82°
BEACON EXPLORER BE-A	To study for a minimum period of 1 year the variations of electron density distribution as a function of latitude, and seasonal and diurnal time, under varying magnetic and solar conditions.	Mar. 19, 1964 Mar. 19, 1964	Delta ETR	Note Remarks			Frank T. Martin Robert E. Bourdeau	Four coherent, ultra-stable, unmodulated CW transmitters (operating at 20, 40, 41, and 360 Mc) radiate signals from dipole antennas for reception by a worldwide network of over 100 observing stations.	Measurement of electron content–I Absorption, scintillation–I	Frank T. Martin Robert E. Bourdeau	U. of Illinois Pennsylvania State U. NBS Stanford U. and international participants	Observing Stations: Stations operated by prime experimenters: a. University of Illinois: Urbana, Illinois; Houghton, Michigan; Baker Lake, Canada; Adak, Alaska

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PART I

GODDARD SPACE FLIGHT CENTER SATELLITES AND SPACE PROBE PROJECTS (Cont.)

Designation	Objectives	LAUNCH AND ORBIT DATA					Project Manager and Project Scientist	EXPERIMENT DATA				Remarks
		Launch Date/ Silent Date	Vehicle & Launch Site	Period (Min.)	Statute Miles: Perigee	Statute Miles: Apogee		Instrumentation Summary	Experiment and Discipline*	Experimenter	Affiliation	
BE-A (Continued)												b. Pennsylvania State U. University Park, Pennsylvania Huancayo, Peru c. Stanford University: Stanford, California Honolulu, Hawaii; Macapa, Brazil; Guarapes, Brazil; S. J. dos Campos Brazil; Santiago, Chile; Ushuaia, Argentina d. Central Radio Propagation Laboratory (NBS): Boulder, Colorado; 2 mobile stations within 100-mile radius of Boulder, Colorado International Participation: More than 100 international observing ground stations participated in the program. Doppler tracking data both from Antigua and Brazil tracking stations indicated that the satellite did not achieve orbital velocity. The satellite re-entered the earth's atmosphere over the South Atlantic coast of Argentina and disintegrated. This was the first Delta vehicle failure in 23 launch attempts. Weight: 172 lb.
ARIEL II INTERNATIONAL SATELLITE 1964 15A	To continue U.S. - U.K. cooperative satellite program. This is second phase of a three-satellite program. The satellite mission is to make scientific measurements using the	Mar. 27, 1964	Scout Wallops Island	102	180	840	Emil Hymowitz Lawrence Dunkelman	Ariel II is designed to perform three experiments: the galactic-noise experiment to record galactic noise in the 0.75- to 3.0 Mc region and to explore the ionosphere; the ozone	Measurement of galactic radio noise in the 0.75- to 3.0-Mc frequency range—I Measure vertical distribution of atmospheric ozone—P	F. G. Smith K. H. Stewart	U. of Cambridge (U.K.) Air Ministry (U.K.)	This satellite is a cooperative U.S.-U.K. effort. The U.K. was responsible for all flight instrumentation pertaining to the experiments and for

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PART I

GODDARD SPACE FLIGHT CENTER SATELLITES AND SPACE PROBE PROJECTS (Cont.)

Designation	Objectives	LAUNCH AND ORBIT DATA					Project Manager and Project Scientist	EXPERIMENT DATA				Remarks
		Launch Date/ Silent Date	Vehicle & Launch Site	Period (Min.)	Statute Miles			Instrumentation Summary	Experiment and Discipline*	Experimenter	Affiliation	
					Perigee	Apogee						
ARIEL II (Continued)	U.K.-furnished experiments.							experiment to measure the vertical distribution of ozone in the earth's atmosphere; and the micrometeorite experiment to obtain quantitative measurements of particle flux.	Measurement of the micrometeoroid flux–A	R. C. Jennison	U. of Manchester. Jodrell Bank (U.K.)	data-reduction analysis. The U.S. was responsible for the design, fabrication and testing of the prototype-flight spacecraft and all subsystems, except for the experiment requirements. Tracking and data acquisition are joint responsibility. Inclination: 52° Power: Solar
SYNCOM III	To provide experience in using communications satellites in a 24-hour near-equatorial orbit. To flight-test a new, simple approach to satellite attitude and period control. To develop transportable ground facilities to be used in conjunction with communications satellites. To develop capability of launching satellites into 24-hour near-equatorial orbit using existing vehicles plus apogee-kick techniques and to test components life at 24-hour orbit altitude.	Aug. 19, 1964	Thrust-augmented Delta ETR		22,300 synchronous orbit		R. J. Darcey	The 24-hour communications satellite consists of a spin-stabilized active repeater in a near-synchronous low-inclination orbit. The spacecraft is in the form of a cylinder, 28 inches in diameter and 15 inches high. The repeater consists of a 7200-Mc receiver and an 1800-Mc transmitter with an output of 2 watts. In addition, the spacecraft contains a vernier velocity-control system for orientation of spin axis and adjustment of the orbit.				Orbit and attitude control of the spin-stabilized satellite into near-equatorial synchronous orbit achieved. Data, telephone, and facsimile transmissions were excellent. Television video signals were successfully transmitted through the wideband (13-Mc) transponder. Weight: 70 lb. Power: Solar
EXPLORER XX IE-A	To measure the electron density distribution in space and time between the height of the maximum electron density in the F2 region (approximately 180 miles) and the height of the satellite (620 miles) including the geometry and number of irregularities. To determine the ion and electron densities and temperatures in the vicinity of the satellite and to estimate cosmic noise in the 2- to 7-Mc frequency range.	Aug. 25, 1964	Scout WTR	104	538	628	E. Dale Nelsen	Six ionosphere explorers from 1.50- to 7.22 Mc and an ion mass spectrometer (U.K.). The longest set of sounding antenna will measure 122 feet, tip to tip. Scientific data will be transmitted via a 2-watt FM telemetry system; upon command, data acquired in real time only. Housekeeping data acquired from a ¼-watt PM telemetry transmitter.	Fixed-frequency sounder–I Ion probe–I	R. Knecht R. L. F. Boyd A. P. Willmore	CRPL/NBS U. College, London	26 inches in diameter and 32-½ inches high; 2400 solar cells mounted round side of satellite. Weight: 97.9 lb. Power: Solar

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Designation	Objectives	LAUNCH AND ORBIT DATA					Project Manager and Project Scientist	EXPERIMENT DATA				Remarks
		Launch Date/ Silent Date	Vehicle & Launch Site	Period (Min.)	Statute Miles			Instrumentation Summary	Experiment and Discipline*	Experimenter	Affiliation	
					Perigee	Apogee						
NIMBUS I	To provide a large amply powered earth-stabilized spacecraft and tests of a variety of sensors for atmospheric research coupled with a ground data-handling system to acquire and process atmospheric data in real time.	Aug. 28, 1964 Sept. 23, 1964	Thor-Agena B WTR	98.7	263	579	Harry Press William Nordberg	Television cameras to photograph earth's cloud cover; equipment for infrared radiation measurements. Two large paddles of solar cells convert the sun's energy into electric power. Spacecraft also has tape recorders, PCM telemetry, and 128 coded commands.	Advanced vidicon camera system Automatic picture transmission system High-resolution infrared radiometer	G. Burdett G. Hunter L. Foshee	GSFC GSFC GSFC	Due to premature burnout of Thor-Agena second stage, the spacecraft was launched into a highly elliptical orbit instead of the intended 550-mile circular orbit. Weight: 830 lb.
ORBITING GEOPHYSICAL OBSERVATORY OGO-I	To launch and operate an orbital spacecraft carrying experiments to make scientific geophysical measurements about the earth.	Sep. 4, 1964	Atlas-Agena B ETR	63.983 hours	175	92,827	Wilfred E. Scull Dr. G. H. Ludwig	The first in a series of standardized "street car" satellites. This concept envisions a basic scientific spacecraft, capable of accommodating as many as 50 different experiments.	Triaxial search-coil magnetometer–E Rubidium-vapor magnetometer–E Spherical ion and electron trap–I Planar ion and electron trap–I Radio propagation–I Atmospheric mass spectrum–R Interplanetary dust particles–P VLF noise and propagation–I Radio astronomy–A Geocoronal Lyman-alpha scattering–P Gegenschein photometry–P Solar cosmic rays–S Plasma, electrostatic analyzer–E Plasma, Faraday Cup–E Positron search and gamma-ray spectrum–ES Trapped radiation, scintillation counter–E Cosmic-ray isotope abundance–E	E. J. Smith R. E. Holzer J. P. Heppner R. C. Sagalyn E. C. Whipple R. S. Lawrence H. A. Taylor, Jr. W. M. Alexander R. A. Helliwell F. T. Haddock P. W. Mange C. L. Wolff K. Hallam S. P. Wyatt K. A. Anderson J. H. Wolfe H. J. Bridge T. L. Cline E. W. Hones, Jr. A. Konradi G. H. Ludwig F. B. McDonald	JPL UCLA GSFC AFCRL GSFC NBS GSFC GSFC Stanford U. U. of Michigan NRL GSFC GSFC U. of Illinois U. of California ARC MIT GSFC Inst. Def. Anal. GSFC GSFC GSFC	Performance of the Atlas-Agena launch rocket was normal. However, shortly after separation from the Agena second stage it appeared that the mission might be in jeopardy because of nondeployment of two booms. This resulted in abnormal operation of the automatic control system to lock the spacecraft into its earth-stabilized orbit. The inability to lock on the earth was later attributed to the fact that the satellite's earth-seeking sensor was obscured by one of the undeployed booms. About 4½ hours after launch, OGO I was commanded into a "hold" condition while project officials evaluated telemetry data and prepared a contingency operations plan for a spin-stabilized spacecraft. Weight: 1048 lb. Power: Solar Inclination: 31°

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PART I

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Designation	Objectives	LAUNCH AND ORBIT DATA: Launch Date/ Silent Date	Vehicle & Launch Site	Period (Min.)	Statute Miles: Perigee	Apogee	Project Manager and Project Scientist	EXPERIMENT DATA: Instrumentation Summary	Experiment and Discipline*	Experimenter	Affiliation	Remarks
OGO-I (Continued)									Cosmic-ray spectra and fluxes–E	J. A. Simpson	U. of Chicago	
									Trapped radiation, omnidirectional counters–E	J. A. Van Allen	U. of Iowa	
									Trapped radiation, electron spectrometer–E	J. R. Winckler R. L. Arnoldy	U. of Minnesota	
EXPLORER XXI INTERPLANETARY EXPLORER PLATFORM (IMP B)	A detailed study of the radiation environment of cislunar space and monitoring this region over a significant portion of a solar cycle (11 years). To study the quiescent properties of the interplanetary magnetic field and its dynamical relationships with particle fluxes from the sun. Development of a solar flare prediction capability for Apollo. The extension of knowledge of solar terrestrial relationships. To further the development of simple, inexpensive, spin-stabilized spacecraft for interplanetary investigation.	Oct. 3, 1964	Delta ETR	35 hours	120	59,400	Paul Butler Dr. F. B. McDonald	Carries 9 experiments; it is spin-stabilized and powered by solar cells. The system is designed so that data can be received from apogee by the GSFC Minitrack stations.	MAGNETIC FIELD			The satellite failed to achieve the required orbit of 161,000-mile apogee. Weight: 136 lb. Power: Solar
									Rubidium vapor magnetometers–E	N. F. Ness	GSFC	
									Fluxgate magnetometer–E	N. F. Ness	GSFC	
									COSMIC RAY			
									Range versus energy loss–E	J. A. Simpson	Enrico Fermi Inst. U. of Chicago	
									Energy versus energy loss–E	F. B. McDonald G. H. Ludwig	GSFC GSFC	
									Orthagonal geiger counter telescope–E	F. B. McDonald G. H. Ludwig	GSFC GSFC	
									Ion chamber and geiger counter tubes–E	K. A. Anderson	U. of California	
									SOLAR WIND			
									Low-energy proton analyzer–E	J. H. Wolfe	ARC	
									Plasma probe–E	H. S. Bridge	MIT	
									Thermal ion electron sensor–E	R. Bourdeau G. P. Serbu	GSFC GSFC	
EXPLORER XXII BEACON EXPLORER-B	To study for a minimum period of 1 year the variations of electron content distribution as a function of latitude, and seasonal and diurnal time, under varying magnetic and solar conditions. To support the beacon experiment by determining the electron density in the vicinity of the spacecraft. To test the feasibility of laser tracking.	Oct. 9, 1964	Scout WTR	104	549	669	Frank T. Martin Robert E. Bourdeau	Four coherent, ultra-stable, unmodulated CW transmitters (operating at 20, 40, 41, and 360 Mc) radiate signals from dipole antennas which are received by a world-wide network of over 80 observing stations. Two electron density probes. Laser corner reflector.	Ionosphere beacon–I	G. W. Swenson W. J. Ross U. K. Garriott R. S. Lawrence L. J. Blumle	U. of Illinois Pennsylvania State U. Stanford U. NBS GSFC International participants	Observing Stations: Stations operated by prime experimenters: a. University of Illinois: Urbana, Illinois; Houghton, Michigan; Baker Lake, Canada; Adak, Alaska b. Pennsylvania State University; University Park, Pennsylvania Huancayo, Peru
									Electron density–I	L. Brace	GSFC	
									Laser tracking	H. Plotkin	GSFC	

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PART I

GODDARD SPACE FLIGHT CENTER SATELLITES AND SPACE PROBE PROJECTS (Cont.)

Designation	Objectives	LAUNCH AND ORBIT DATA					Project Manager and Project Scientist	EXPERIMENT DATA				Remarks
		Launch Date/ Silent Date	Vehicle & Launch Site	Period (Min.)	Statute Miles			Instrumentation Summary	Experiment and Discipline*	Experimenter	Affiliation	
					Perigee	Apogee						
EXPLORER XXII (Continued)												c. Stanford University: Stanford, California; Honolulu, Hawaii; Macapa, Brazil; S. J. dos Compos, Brazil; Santiago, Chile; Ushuaia, Argentina d. Central Radio Propagation Laboratory (NBS): Boulder, Colorado: 2 mobile stations within 100-mile radius of Boulder, Colorado. e. Goddard Space Flight Center (GSFC): Blossom Point, Maryland International Participation: More than 80 international observing ground stations are participating in the program. Laser stations located at Wallops Island and GSFC. Weight: 115 lb.
EXPLORER XXVI ENERGETIC PARTICLES EXPLORER-D	To study the injection, trapping, and loss of mechanisms of the trapped radiation belt (natural and artificial). The particle measurements will be correlated with data from the magnetic field experiment.	Dec. 21, 1964	Delta ETR	456	190	16,250	Gerald W. Longanecker Leo Davis	The spacecraft is spin-stabilized at 25 rpm/ nominal and powered by p-on-n solar cells.	Electron-proton angular distribution and energy spectra Electron-proton directional-omnidirectional detectors Magnetic field measurements Ion-electron detector Solar-cell damage	W. L. Brown C.E. McIlwain Laurence Cahill Leo R. Davis J. M. Williamson L. W. Slifer	Bell Telephone Lab. U. of California U. of New Hampshire GSFC GSFC	The satellite will continue the work of earlier satellites in the explorer series which measured the Van-Allen and the artificial radiation belts, produced by the Starfish nuclear explosions in the Pacific. Weight: 101 lb. Power: Solar Inclination: 20.1°

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PART II
SCHEDULED SATELLITE PROJECTS
PARTIAL LISTING

Designation	Objectives	LAUNCH AND ORBIT DATA: Launch Date/ Silent Date	Vehicle & Launch Site	Period (Min.)	Statute Miles: Perigee	Apogee	Project Manager and Project Scientist	EXPERIMENT DATA: Instrumentation Summary	Experiment and Discipline*	Experimenter	Affiliation	Remarks
ORBITING SOLAR OBSERVATORY OSO-B2	To conduct experiments in solar physics above the earth's atmosphere; experiments will detect and measure electromagnetic radiation from the sun and determine its energy level.	1965	Delta ETR	95.73	345 circular orbit		Laurence T. Hogarth Dr. John C. Lindsay	Stablized platform for solar-oriented scientific instruments. Experiments not requiring fixed orientation with respect to the sun are housed in the spinning wheel section of the satellite. Electrical power is supplied by an array of solar cells mounted on the stabilized section. A complete telemetry and command system is provided to transmit information back to earth. Essential difference between OSO-1 and OSO-B2 is ability of OSO-B2 to scan solar disc and corona with pointed instruments.	POINTED Ultraviolet spectrometer-spectroheliograph 300-1400A – S	L. Goldberg E. M. Reeves W. H. Parkinson W. Liller	Harvard U.	Weight: 545 lb. (320 for spacecraft and 225 for experiments) Power: Solar Inclination: 33°
									Monitor solar X-ray bursts 2 - 8A, 8 - 20A, and 44 - 60A - S	T. A. Chubb	NRL	
									White light coronagraph-spectroheliograph Lyman-alpha, He I and He II lines – S	R. Tousey	NRL	
									WHEEL Monitor intensity and direction of polarized light from interplanetary space – A	E. P. Ney	U. of Minnesota	
									Measure arrival direction and energies of primary cosmic-gamma rays 100 Mev to 1 Bev-A	C. P. Leavitt	U. of New Mexico	
									Detect gamma rays and analyze their energy spectrum 0.1-0.7 Mev–S	K. J. Frost	GSFC	
									Ultraviolet stellar and nebular spectrophotometer 1500 – 3200 A, – A	K. L. Hallam	GSFC	
									Measurement of thermal-radiation characteristics of surfaces to determine emissivity stability of spacecraft temperature-control coatings – E	C. B. Neel	ARC	
TIROS I (Eye) A-54	To launch a space- that will contribute to the development of a global meteorological observation system.	1965	Delta ETR	97.5	400	400	Robert Rados	Two standard TIROS cameras with recorders, two IR horizon sensors for attitude determination, a magnetic attitude control system; horizon sensors will be used with an onboard spacecraft computer to provide camera shutter at spacecraft local vertical. Magnetic spin control and spacecraft digital clock to be used.				This mission will endeaver to increase the area of meteorological observation, to improve the accuracy of TV picture location and to eliminate attitude constraints through the use of a cart-wheel-configured satellite in a nearly sun-synchronous (82° retrograde) polar orbit. This configuration will permit the cameras to view the earth and its cloud cover at zenith and will be limited in coverage only by the sun's coverage of

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PART II
SCHEDULED SATELLITE PROJECTS
PARTIAL LISTING

Designation	Objectives	LAUNCH AND ORBIT DATA: Launch Date/ Silent Date	Vehicle & Launch Site	Period (Min.)	Statute Miles: Perigee	Statute Miles: Apogee	Project Manager and Project Scientist	EXPERIMENT DATA: Instrumentation Summary	Experiment and Discipline*	Experimenter	Affiliation	Remarks
TIROS I (Eye) (Continued)												the earth and the limitations of the satellites power system. Weight: 305 lb. Power: Solar 82° retrograde
BE-C (IONOSPHERE BEACON) S-66 b	Ionosphere: To study for a minimum period of one year the variations of electron content distribution as a function of latitude, and seasonal and diurnal time, under varying magnetic and solar conditions. To support the beacon experiment by determining the electron density in the vicinity of the spacecraft. To test the feasibility of laser tracking. Geodesy: To study detailed perturbations in orbits of satellites to deduce the size and shape of the earth and the nature of its gravity field.	1965	Scout WI		621.4	683.5	Frank T. Martin Robert E. Bourdeau Geodesy: Robert Newton	Ionosphere: Four-coherent, ultrastable, unmodulated CW transmitters (operating at 20, 40, 41 and 360 Mc) radiate signals from dipole antennas which are received by a world-wide network of over 80 observing stations. Two electron density probes. Laser corner reflector. Geodesy: Two coherent, ultrastable, unmodulated CW transmitters (operating at 162 and 324 Mc) radiate signals from dipole antennas which are received by a world-wide network of over 80 observing stations. Two electron density probes. Laser corner reflector.	Ionosphere beacon–I Electron density–I Laser tracking Geodesy	G. W. Swenson W. J. Ross U. K. Garriott R. S. Lawrence L. J. Blumle L. Brace H. Plotkin Geodesy: R. Newton	U. of Illinois Pennsylvania State U. Stanford U. NBS GSFC International participants GSFC GSFC APL	Observing Stations: Stations operated by prime experimenters Ionosphere: a. University of Illinois Urbana, Illinois; Houghton, Michigan; Baker Lake, Canada; Adak, Alaska b. Pennsylvania State University; University Park Pennsylvania Huancayo, Peru Geodesy: Tranet – APL
EARLY BIRD HS-303 (First satellite project of the Communications Satellite Corp.)	Communications	1965	TAD ETR				C. P. Smith					GSFC providing launching and associated services. Satellite operation is the responsibility of the Communications Satellite Corp.
IMP C	To study in detail the radiation environment of cislunar space and to monitor this region over a significant portion of a solar cycle. To study the quiescent properties of the interplanetary magnetic field and its dynamical relationships with particle fluxes from the sun. To develop a solar flare prediction capability for Apollo. To extend the knowledge of solar terrestrial relationships. To further the development of simple, inexpensive, spin-stabilized spacecraft for interplanetary investigations.	1965	Delta ETR				Paul Butler F. B. McDonald	To carry 10 experiments; essentially a combination of the successful GSFC Explorer X and XII satellites. To be spin-stabilized and powered by solar cells. The system to be designed so that data can be received from apogee by the GSFC Minitrack stations.	Plasma-measure thermal ions and electrons 0.10 ev-1 Magnetic field experiment (fluxgate magnetometer)–E Measure solar and galactic protons and alpha particles–E Measure total ionization produced per unit time in a unit volume of standard density air–E Measure flux of low-energy interplanetary plasma–E Measure solar and galactic protons, electrons, alpha particles, heavy primaries, and	G. P. Serbu R. Bourdeau N. F. Ness J. A. Simpson K. A. Anderson H. S. Bridge F. McDonald G. Ludwig	GSFC GSFC U. of Chicago U. of California MIT GSFC	

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E – Energetic Particles and Fields
I – Ionospheric Physics
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PART II
SCHEDULED SATELLITE PROJECTS
PARTIAL LISTING

Designation	Objectives	LAUNCH AND ORBIT DATA: Launch Date/ Silent Date	Vehicle & Launch Site	Period (Min.)	Statute Miles: Perigee	Statute Miles: Apogee	Project Manager and Project Scientist	EXPERIMENT DATA: Instrumentation Summary	Experiment and Discipline*	Experimenter	Affiliation	Remarks
IMP C (Continued)									isotrophy of solar proton events and of cosmic-ray modulation–E Magnetic field (rubidium-vapor magnetometer)–E Solar wind proton concentrations–E	 N. F. Ness John Wolfe	 GSFC ARC	
ISIS-X (DME-A ALOUETTE B)	The top side of the ionosphere by utilizing topside sounder and direct measurement techniques.	1965	Thor-Agena B WTR				E. Dale Nelsen J. E. Jackson					
ATMOSPHERE EXPLORER AE-B	To study the structure and physics of the upper atmosphere between 156 and 750 statute miles.	1965	Delta ETR	97	156	750	C. C. Stephanides L. H. Brace	Experiments consist of two double-focusing magnetic neutral-particle mass spectrometers, three cold-cathode total-pressure ionization gauges, two electrostatic probes, and one Bennett-type ion-mass spectrometer. The spacecraft contains an active magnetic attitude control system, redundant PCM telemetry systems and a tape recorder.	Neutral Particle Mass Spectrometers–RP Pressure Gauges–RP Electrostatic Probes–RPI Ion Mass Spectrometer–RPI	C. Reber J. Cooley G. P. Newton L. Brace H. A. Taylor H. Brinton R. A. Pickett		Weight: 480 lb. Power: Battery (Primary) Solar
FRENCH FR1-A	To study the properties of the VLF wave field in the magnetosphere; to study the irregularities and the distribution of ionization in the magnetosphere.	1965	Scout WTR				S. R. Stevens R. W. Rochelle			L. R. O. Storey	CNET France (Centre National d'Etudes de Telecommunication)	
OPERATIONAL TIROS OT-1 OT-3	To provide additional operational data for WB requirements.	1965 1965	Delta ETR Improved TAD ETR				Robert Rados Robert Rados					
ORBITING GEOPHYSICAL OBSERVATORY OGO-C	To launch and operate an orbital spacecraft carrying experiments to make scientific geophysical measurements about the earth, from a low-altitude polar orbit of low eccentricity.	1965	Thrust-augmented Thor-Agena D WTR		161	575	Wilfred E. Scull N. W. Spencer	The spacecraft can accommodate as many as 50 experiments.	Radio astronomy – A VLF measurements – I VLF measurements – I Triaxial search-coil magnetometer – E Rubidium-vapor magnetometer – E Cosmic-ray and polar-region ionization study – E	F. T. Haddock R. A. Helliwell M. G. Morgan T. Laaspere R. E. Holzer E. J. Smith J. P. Heppner H. R. Anderson H. V. Heher	U. of Michigan Stanford U. Dartmouth College UCLA JPL GSFC JPL California Institute Tech.	Weight: 1000 lb.

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PART II
SCHEDULED SATELLITE PROJECTS
PARTIAL LISTING

Designation	Objectives	Launch and Orbit Data: Launch Date/ Silent Date	Vehicle & Launch Site	Period (Min.)	Statute Miles: Perigee	Apogee	Project Manager and Project Scientist	Experiment Data: Instrumentation Summary	Experiment and Discipline*	Experimenter	Affiliation	Remarks
ORBITING GEOPHYSICAL OBSERVATORY OGO-C (Continued)									Energetic particles survey - E	J. A. Simpson	U. of Chicago	
									Galactic and solar-cosmic rays - E	W. R. Webber	U. of Minnesota	
									Corpuscular radiation in auroral and polar zones - E	J. A. Van Allen	U. of Iowa	
									Trapped-radiation scintillation detector - E	R. A. Hoffman	GSFC	
									Air-glow study - R	J. Blamont E. Reed	U. of Paris GSFC	
									Lyman-alpha and air-glow study - R	P. W. Mange	NRL	
									Air-glow study, undervoltage spectrometer - R	C. A. Barth L. Wallace	JPL Kitt Peak Nat. Obs.	
									Neutral particles and ion-composition study - R	E. J. Schaefer	U. of Michigan	
									Positive ion study - R	H. A. Taylor, Jr.	GSFC	
									Neutral particle study - R	G. P. Newton	GSFC	
									Micrometeorites - P	W. M. Alexander	GSFC	
									Ionospheric composition and undervoltage flux - I	R. E. Bourdeau	GSFC	
									Undervoltage spectrometer - S	H. E. Hinteregger	AFCRL	
									Solar X-rays - S	R. W. Kreplin	NRL	
ORBITING SOLAR OBSERVATORY OSO-C	To conduct experiments in solar physics above the earth's atmosphere; experiments will detect and measure electromagnetic radiation from the sun and determine its energy level.	1965	Delta ETR	95.73	345 circular orbit		Laurence T. Hogarth Dr. John C. Lindsay	Stabilized platform for solar-oriented scientific instruments. Experiments not requiring fixed orientation with respect to the sun are housed in the spinning wheel section of the satellite. Electrical power is supplied by an array of solar cells mounted on the stabilized section. A complete telemetry system is provided to transmit information back to earth. Spacecraft has pointing capability similar to OSO-1 and OSO-B2.	POINTED Ultraviolet monochromator 250 - 1300A - S	H. E. Hinteregger	AFCRL	Weight: 595 lb. (325 for spacecraft and 270 for experiments) Power: Solar Inclination: 33°
									Solar spectrometer 1-400A - S	W. M. Neupert	GSFC	
									WHEEL Earth's albedo in ultraviolet and visible regions 3200 - 7800A - A	C. B. Neel	ARC	
									Emissivity stability of low-temperature coatings - E	C. B. Neel	ARC	
									Celestial gamma-ray astronomy 100 Mev and greater - A	W. L. Kraushaur	MIT	
									Solar X-ray 8 - 20A - S	R. Teske	U. of Michigan	

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PART II
SCHEDULED SATELLITE PROJECTS
PARTIAL LISTING

Designation	Objectives	LAUNCH AND ORBIT DATA					Project Manager and Project Scientist	EXPERIMENT DATA				Remarks
		Launch Date/ Silent Date	Vehicle & Launch Site	Period (Min.)	Statute Miles			Instrumentation Summary	Experiment and Discipline*	Experimenter	Affiliation	
					Perigee	Apogee						
ORBITING SOLAR OBSERVATORY OSO-C (Continued)									Cosmic-ray charge spectrum detector to measure nuclear component of primary radiation and high-energy gamma radiation > 100 Mev from sun and galaxy – S	M. F. Kaplon	U. of Rochester	
									Directional radiometer 1 – 30μ	C. B. Neel	ARC	
									Solar X-ray telescope 7 – 190 Kev and anti-coincidence events at 100 Kev and 2.5 Mev – S	L. E. Peterson	U. of California	
NIMBUS C	To extend the meteorological data obtained with Nimbus I to a broad range of seasonal and hemispheric variations in weather systems, and test new sensors in the infrared radiation region.	1966	TAT – Agena B WTR	107	690	690	Harry Press William Nordberg	Television cameras to photograph earth's cloud cover; equipment for infrared radiation measurements. Two large paddles of solar cells convert the sun's energy into electric power. Spacecraft also has tape recorders, PCM telemetry, and 128 coded commands.	Advanced vidicon camera system	J. Schulman	GSFC	Weight: 900 lbs
									Automatic picture transmission system	J. Schulman	GSFC	
									High-resolution infrared radiometer	L. Foshee	GSFC	
									Medium-resolution infrared radiometer	A. McCulloch	GSFC	
ORBITING GEOPHYSICAL OBSERVATORY OGO-B	To launch and operate an orbital spacecraft carrying experiments to make scientific geophysical measurements about the earth.	1966	Atlas – Agena B ETR		172	92,124	Wilfred E. Scull Dr. G. H. Ludwig	The spacecraft can accommodate as many as 50 experiments.	Solar cosmic rays – S	K. A. Anderson	U. of California	To be placed in a highly eccentric orbit (31°) Weight: 1048 lb. Power: Solar
									Plasma, electrostatic analyzer – E	J. H. Wolfe	ARC	
									Plasma, Faraday cup – E	H. J. Bridge	MIT	
									Positron search and gamma-ray spectrum – E&S	T. L. Cline E. W. Hones, Jr.	GSFC Inst. Def. Anal.	
									Trapped radiation, scintillation counter – E	A. Konradi	GSFC	
									Cosmic-ray isotope abundance – E	G. H. Ludwig F. B. McDonald	GSFC GSFC	
									Cosmic-ray spectra and fluxes – E	J. A. Simpson	U. of Chicago	
									Trapped radiation, omnidirectional counters – E	J. A. Van Allen	U. of Iowa	
									Trapped radiation, electron spectrometer and ionization chamber – E	J. R. Winckler R. L. Arnoldy	U. of Minnesota	
									Triaxial search-coil magnetometer – E	E. J. Smith R. E. Holzer	JPL UCLA	
									Rubidium-vapor magnetometer – E	J. P. Heppner	GSFC	
									Spherical ion and electron trap – I	R. C. Sagalyn	AFCRL	
									Planar ion and electron trap – I	E. C. Whipple	GSFC	

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E – Energetic Particles and Fields
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PART II
SCHEDULED SATELLITE PROJECTS
PARTIAL LISTING

Designation	Objectives	LAUNCH AND ORBIT DATA: Launch Date/ Silent Date	Vehicle & Launch Site	Period (Min.)	Statute Miles: Perigee	Apogee	Project Manager and Project Scientist	EXPERIMENT DATA: Instrumentation Summary	Experiment and Discipline*	Experimenter	Affiliation	Remarks
ORBITING GEOPHYSICAL OBSERVATORY OGO-B (Continued)									Radio propagation – I Atmospheric mass spectrum – R Interplanetary dust particles – P VLF noise and propagation – I Radio astronomy – A Geocoronal Lyman-alpha scattering – P Gegenschein photometry – P	R. S. Lawrence H. A. Taylor, Jr. W. M. Alexander R. A. Helliwell F. T. Haddock P. W. Mange C. L. Wolff K. Hallam S. P. Wyatt	NBS GSFC GSFC Stanford U. U. of Michigan NRL GSFC GSFC U. of Illinois	
APPLICATIONS TECHNOLOGICAL SATELLITE ATS-A ATS-B ATS-C ATS-D ATS-E	To obtain engineering data on earth-oriented gravity-gradient stabilization at medium altitudes to extend techniques to synchronous altitudes; also, meteorological, environmental, and communication measurements. To provide a platform both spin-stabilized and earth-oriented at medium and synchronous altitudes.		Atlas - Agena D ETR Atlas - Agena D ETR	360 1436	6000 circular orbit 22,200 circular orbit		Robert J. Darcey	Gravity-gradient control stabilization system will provide performance data utilizing attitude data and cameras to observe boom deflections. Gravity-gradient camera, meteorological pictures, and communications will be transmitted via a 4-kMc transmitter. Environmental and technical experiments will be transmitted at 136 Mc. For the spin-stabilization mission, a 4-kMc signal will be directed towards the earth by an electrical or mechanical despun antenna.	ATS-A Omnidirectional particle detectors Multielement silicon junction particle detector VLF whistler mode power detector Electron spectrometer Solar-cell radiation damage Thermal coating Cosmic radio noise measurement	C. McIlwain W. L. Brown W. L. Brown J. Winckler R. Waddel J. J. Triolo R. G. Stone	U. of California BTL BTL U. of Minnesota GSFC GSFC GSFC	Weight: 800 lb. ATS-A 1550 lb. ATS-B, C, D, and E Power: Solar Inclination: 30° ATS-A 0° ATS-B, C, D and E
ORBITING ASTRONOMICAL OBSERVATORIES OAO-A OAO-B OAO-C	To make precise telescope observations from above the earth's atmosphere with satellites under control from the ground. The area of interest is that of the emission and absorption characteristics of the sun, stars, planets, nebulae and interplanetary, and interstellar media in the relatively unexplored infrared, ultraviolet, X-ray, and gamma-ray regions of the spectrum. To develop a basic spacecraft which will have the precise pointing		Atlas-Agena ETR		547 circular orbit		Robert R. Ziemer Dr. J. E. Kupperian, Jr.	Carries a wide variety of astronomical experiments.	(OAO-A) Mapping stellar undervoltage radiation in ranges 3000-1700A, 200-1050A, 1500-1050A – A (OAO-A) broadband photometric studies of stellar energy distribution (800-3000A) – A (OAO-B) Absolute spectrophotometry measurement (1000-4000A with 2A resolution) – A (OAO-C) Inter-stellar absorption measurement (800-3000A with 0.1 resolution) – A	F. Whipple R. Davis A. Code J. Kupperian J. E. Milligan L. Spitzer	Smithsonian Astrophysical Observatory U. of Wisconsin GSFC Princeton U.	Experiments for the first three observations have been selected and are scheduled as follows: OAO-A Smithsonian Astrophysical Observatory experiment; University of Wisconsin experiment. OAO-B GSFC experiment. OAO-C Princeton University experiment. The Smithsonian experiment is designed to map the sky as it looks in ultraviolet light. The Wisconsin experiment is to give more details about

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PART II
SCHEDULED SATELLITE PROJECTS (Cont.)
PARTIAL LISTING

Designation	Objectives	LAUNCH AND ORBIT DATA: Launch Date/ Silent Date	Vehicle & Launch Site	Period (Min.)	Statute Miles: Perigee	Statute Miles: Apogee	Project Manager and Project Scientist	EXPERIMENT DATA: Instrumentation Summary	Experiment and Discipline*	Experimenter	Affiliation	Remarks
ORBITING ASTRONOMICAL OBSERVATORIES OAO-A OAO-B OAO-C (Continued)	capability, power, and data-handling equipment, etc.											the amount and distribution of ultra-violet light in selected stars. The GSFC experiment will obtain more detailed data on selected stars, using a 36-inch telescope and a spectrophotometer. The Princeton experiment will be designed for high-resolution ultra-violet studies involving observations to determine some of the characteristics of the gas between stars. Weight: 3600 lb.
ORBITING GEOPHYSICAL OBSERVATORY OGO-D	To launch and operate an orbital spacecraft carrying experiments to make scientific geophysical measurements about the earth, from a low-altitude polar orbit of low eccentricity.	1966	TAT/ Agena D WTR	≈90	161	575	Wilfred E. Scull N. W. Spencer	The spacecraft can accommodate as many as 50 experiments.	Radio astronomy – A	F. T. Haddock	U. of Michigan	Weight: 1000 lb.
									VLF measurements – I	R. A. Helliwell	Stanford U.	
									VLF measurements – I	M. G. Morgan T. Laaspere	Dartmouth College	
									Triaxial search-coil magnetometer – E	R. E. Holzer E. J. Smith	UCLA JPL	
									Rubidium-vapor magnetometer – E	J. P. Heppner	GSFC	
									Cosmic-ray and polar-region ionization study – E	H. R. Anderson H. V. Neher	JPL California Inst. Tech.	
									Energetic particles survey – E	J. A. Simpson	U. of Chicago	
									Galactic and solar-cosmic rays – E	W. R. Webber	U. of Minnesota	
									Corpuscular radiation in auroral and polar zones – E	J. A. Van Allen	U. of Iowa	
									Trapped-radiation scintillation detecter – E	R. A. Hoffman	GSFC	
									Air-glow study – R	J. Blamont E. Reed	U. of Paris GSFC	
									Lyman-alpha and air-glow study – R	P. W. Mange	NRL	
									Air-glow study, undervoltage spectrometer – R	C. A. Barth L. Wallace	JPL Kitt Peak Nat. Obs.	

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E – Energetic Particles and Fields
I – Ionospheric Physics
A – Astronomy
P – Planetary Atmospheres
S – Solar Physics

PART II
SCHEDULED SATELLITE PROJECTS (Cont.)
PARTIAL LISTING

Designation	Objectives	LAUNCH AND ORBIT DATA: Launch Date/ Silent Date	Vehicle & Launch Site	Period (Min.)	Statute Miles: Perigee	Apogee	Project Manager and Project Scientist	EXPERIMENT DATA: Instrumentation Summary	Experiment and Discipline*	Experimenter	Affiliation	Remarks
ORBITING GEOPHYSICAL OBSERVATORY OGO-D (Continued)									Neutral particles and ion-composition study - R	E. J. Schaefer	U. of Michigan	
									Positive ion study - R	H. A. Taylor, Jr.	GSFC	
									Neutral particle study - R	G. P. Newton	GSFC	
									Micrometeorites - P	W. M. Alexander	GSFC	
									Ionospheric composition and undervoltage flux - I	R. E. Bourdeau	GSFC	
									Undervoltage spectrometer - S	H. E. Hinteregger	AFCRL	
									Solar X-rays - S	R. W. Kreplin	NRL	
ORBITING GEOPHYSICAL OBSERVATORY OGO-E	To launch and operate an orbital spacecraft carrying experiments to make scientific geophysical measurements about the earth.		Atlas-Agena D WTR	63.983 hours	175	92,827	Wilfred E. Scull Dr. G. H. Ludwig		Electron temperature and density - IE	R. L. F. Boyd	Univ. College, London	
									Thermal and epithermal plasma measurements - IE	R. C. Sagalyn	AFCRL	
									Electron and ion measurement 0-100 ev - IE	G. P. Serbu	GSFC	
									Energetic radiations from solar flares - SE	K. A. Anderson	U. of California	
									Low-rigidity interplanetary electrons, positrons, and protons - E	T. L. Cline	GSFC	
									Electron and proton spectrometer - E	R. D'arcy	Lawrence Radiation Lab.	
									Low-energy electron detector - IE	L. A. Frank	U. of Iowa	
									Energetic protons in primary cosmic rays - EA	G. W. Hutchison	U. of Southhampton, England	
									Cosmic-ray electrons - E	P. Meyer	U. of Chicago	
									Galactic and solar-cosmic rays - E	F. B. McDonald	GSFC	
									Triaxial electron analyzer - IE	K. W. Ogilivie	GSFC	
									Cosmic-ray electrons - E	A. H. Wapstra	Inst. of Nuclear Physics Research, Netherlands	
									Trapped particles - E	P. J. Coleman, Jr.	UCLA	

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E – Energetic Particles and Fields
I – Ionospheric Physics
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P – Planetary Atmospheres
S – Solar Physics

PART II
SCHEDULED SATELLITE PROJECTS (Cont.)
PARTIAL LISTING

Designation	Objectives	LAUNCH AND ORBIT DATA: Launch Date/ Silent Date	Vehicle & Launch Site	Period (Min.)	Statute Miles: Perigee	Statute Miles: Apogee	Project Manager and Project Scientist	EXPERIMENT DATA: Instrumentation Summary	Experiment and Discipline*	Experimenter	Affiliation	Remarks
ORBITING GEOPHYSICAL OBSERVATORY OGO-E (Continued)									Triaxial fluxgate magnetometer – E	P. J. Coleman, Jr.	UCLA	
									Magnetic field measurements – E	J. P. Heppner	GSFC	
									Search-coil magnetometer – IE	E. J. Smith	JPL	
									Plasma spectrometer – IE	C. W. Snyder	JPL	
									Light ion mass spectrometer – PI	C. W. Sharp	LMSC	
									Micrometeorites – PA	W. Alexander	GSFC	
									Radio astronomy – IAS	F. T. Haddock	U. of Michagan	
									Ultraviolet photometric measurements – AI	C. A. Barth	JPL	
									Geocoronal hydrogen – ASE	J. Blamont	U. of Paris	
									Solar ultraviolet photometer – SPI	To be selected		
ORBITING SOLAR OBSERVATORY OSO-D	To conduct experiments in solar physics above the earth's atmosphere; experiments will detect and measure electromagnetic radiation from the sun and determine its energy level.	1966	Delta ETR	95.73	345 circular orbit		Laurence T. Hogarth Dr. John C. Lindsay	Stabilized platform for solar-oriented scientific instruments. Experiments not requiring fixed orientation with respect to the sun are housed in the spinning wheel section of the satellite. Electrical power is supplied by an array of solar cells mounted on the stabilized section. A complete telemetry system is provided to transmit information back to earth. Spacecraft has pointing and scanning capabilty similar to OSO-B2.	POINTED Solar X-ray telescope 8-20A, above 20A, and possibly below 8A – S	R. Giacconi	American Science & Engineering, Inc.	Weight: 600 lb. (330 for spacecraft and 270 for experiments) Power: Solar Inclination: 33°
									Bragg crystal X-ray spectrometer 1-8A – S	T. A. Chubb R. W. Kreplin	NRL	
									Improved normal incidence 300–1300A scanning spectrometer – spectroheliograph – S	L. Goldberg	Harvard U. Observatory	
									WHEEL Measure extrasolar X-radiation 0.1-10A, possibly to 50A – A	R. Giacconi	American Science & Engineering, Inc.	
									Distribution of total solar X-ray emission over a wide band 1-70A in 26 wavelength intervals – S	R. L. F. Boyd	U. College, London; Leicester U.	
									Study of solar He II resonance emission – S	R. L. F. Boyd	U. College, London	
									Proton-electron detector; electrons > 60 Kev, protons > 2 Mev – E	J. Waggoner	U. of California Lawrence Radiation Laboratory	
									X-ray ion chamber monitoring 0.1-1.6A, 0.5-3A, 2-8A, 8-16A – S	T. A. Chubb	NRL	

*R – Aeronomy
E – Energetic Particles and Fields
I – Ionospheric Physics
A – Astronomy
P – Planetary Atmospheres
S – Solar Physics

PART II
SCHEDULED SATELLITE PROJECTS (Cont.)
PARTIAL LISTING

Designation	Objectives	Launch Date/ Silent Date	Vehicle & Launch Site	Period (Min.)	Statute Miles Perigee	Statute Miles Apogee	Project Manager and Project Scientist	Instrumentation Summary	Experiment and Discipline*	Experimenter	Affiliation	Remarks
ORBITING SOLAR OBSERVATORY OSO-D (Continued)									Lyman-alpha nightsky glow 1050-1350A – A	T. A. Chubb	NRL	
ORBITING SOLAR OBSERVATORY OSO-E	To conduct experiments in solar physics above the earth's atmosphere; experiments will detect and measure electromagnetic radiation from the sun, and determine its energy level.	1966	Delta ETR	95.73	345 circular orbit		Laurence T. Hogarth Dr. John C. Lindsay	Stabilized platform for solar-oriented scientific instruments. Experiments not requiring fixed orientation with respect to the sun are housed in the spinning wheel section of the satellite. Electrical power is supplied by an array of solar cells mounted on the stabilized section. A complete telemetry system is provided to transmit information back to earth. Spacecraft has pointing and scanning capability similar to OSO-B2.	POINTED X-ray spectroheliograph 3-9A and 8-18A – S	R. L. F. Boyd E. A. Stewardson P. J. Bowen	U. College, London; U. of Leicester	Weight: 590 lb. (330 for spacecraft and 260 for experiments) Power: Solar Inclination: 33°
									Extreme ultraviolet solar spectroheliograph, Lyman-alpha, He I and He II lines – S	R. Tousey J. D. Purcell H. Friedman	NRL	
									Continuation of the studies of solar spectrum 1-400A – S	J. C. Lindsay W. Neupert	GSFC	
									WHEEL Measurement of self-reversal of the solar Lyman-alpha line – S	J. E. Blamont	U. of Paris	
									Solar X-ray radiation ion- chamber photometer, monitoring experiments 0.1-1.6A, 0.5-3A, 2-8A, and 8-16A – S	R. W. Kreplin	NRL	
									Low-energy gamma-ray region 5-150 Kev – S	K. J. Frost	GSFC	
									Dim-light monitoring experiment measuring intensity and polarization of the light from the air-glow layer – A	E. P. Ney	U. of Minnesota	
									Solar for ultraviolet radiation monitoring in three EUV bands 290-370A, 465-630A, and 760-1030A for effect on ionization rates in F and E atmosphere layers	W. A. Rense	U. of Colorado	
INTERNATIONAL SATELLITE UK-E(UK-3)	To measure vertical distribution of molecular oxygen in earth's atmosphere. To map large scale RF-noise sources in the galaxy, 2- to 5 Mc. To investigate VLF radiation, 3 to 16 kc, both natural and man-made. To measure ionization density and temperature above the F_2		Scout WTR	100	340	340	E. Hymowitz Lawrence Dunkelman	Photomultiplier, three radio receivers, and RF plasma probe	Photomultiplier – P	R. Frith	Meteorological Office, Brockwell	
									Three radio receivers – AP	F. G. Smith	U. of Manchester	
									Radio receivers - AP	T. R. Kaiser	U. of Sheffield	
									RF plasma probe – I	J. Sayers	U. of Birmingham	

*R – Aeronomy
E – Energetic Particles and Fields
I – Ionospheric Physics
A – Astronomy
P – Planetary Atmospheres
S – Solar Physics

PART II
SCHEDULED SATELLITE PROJECTS (Cont.)
PARTIAL LISTING

Designation	Objectives	LAUNCH AND ORBIT DATA					Project Manager and Project Scientist	EXPERIMENT DATA				Remarks
		Launch Date/ Silent Date	Vehicle & Launch Site	Period (Min.)	Statute Miles			Instrumentation Summary	Experiment and Discipline*	Experimenter	Affiliation	
					Perigee	Apogee						
INTERNATIONAL SATELLITE UK-E(UK-3) (Continued)	maximun. To investigate terrestrial radio noise at 5, 10 and 15 MC (thunderstorms).								Radio receiver - AP	J. A. Ratcliffe, FRS	Radio Research Station, Slough	
ADVANCED ORBITING SOLAR OBSERVATORIES	To conduct a continuous systematic study of solar phenomena through measurements that cannot be made inside the earth's atmosphere. To develop a spacecraft system to provide sophistication in control, pointing accuracy, experiment instrumentation capability, and data and communications-handling capability. To develop experimental instrumentation techniques for making best use of this spacecraft system. To sponsor solar physics experiments which must be made on a platform outside the earth's atmosphere.		TAT - Agena WTR		345 circular orbit		A. J. Cervenka Dr. J. C. Lindsay		To be selected			Weight: 1200 lb. Power: Solar
TIROS J	To contribute to the development of a synchronous orbit meteorological satellite system for continuous observation of the earth's atmospheric phenomena.		Improved TAD ETR	154.8	360	3600	Robert Rados	Two vidicon camera systems: a digitized MRIR system, and a magnetic attitude control system.				Weight: 300 lb. Power: Solar 33° prograde

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PART II
SCHEDULED SATELLITE PROJECTS
PARTIAL LISTING

Designation	Objectives	LAUNCH AND ORBIT DATA					Project Manager and Project Scientist	EXPERIMENT DATA				Remarks
		Launch Date/ Silent Date	Vehicle & Launch Site	Period (Min.)	Statute Miles			Instrumentation Summary	Experiment and Discipline*	Experimenter	Affiliation	
					Perigee	Apogee						
TIROS K	To further the development of a synchronous meteoro-logical satellite sys-tem and to develop a capability to provide continuous observa-tion of the earth's atmosphere and con-tinuous coverage of a selected area of the earth.	1966	Improved TAD ETR				Robert Rados					
OPERATIONAL TIROS OT-2	To provide continuing observation of the earth's cloud cover with direct readout TV data on a regular and continuous basis.	1966	Improved TAD ETR				W. W. Jones					
ANCHORED IMP IMP D&E (AIMP)	To anchor a satellite about the moon, to measure in detail the energetic particle population, magnetic fields, and cosmic dust in this orbit, and to explore the vari-ations of the moon's gravitational field.	1966	Improved TAD ETR				P. G. Marcotte N. F. Ness					
TIROS OPERATIONAL SATELLITE TOS A	To provide continuous observation of the earth's cloud cover with stored readout TV data on a regular and continuous basis.	1966	Improved TAD ETR				W. W. Jones					
TOS B TOS C	To provide continuous observation of the earth's cloud cover with direct readout TV data on a regular and continuous basis.	1966	Improved TAD WTR				W. W. Jones					

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NOTES

1. Numbering System:

NASA 4. AEROBEE 150, 150A, 6. AEROBEE 300, 8. ARGO D-4, 10. NIKE CAJUN, 11. ARGO D-8

NASA 12. SPECIAL PROJECTS, 14. NIKE APACHE, 16. ASTROBEE 1500, 17. AEROBEE 350

NASA 1. AEROBEE 100, 2. ARCON, 3. NIKE ASP, 5. IRIS, 7. ARGO E-5, 9. SKYLARK, and 15. ARCAS, are not listed for use on this schedule.

2. Identifying letters: The letters which follow each rocket number identify
(1) the instrumenting agency, and
(2) the experiment according to the following list:

AGENCY

G – Goddard
N – Other NASA Centers
U – College or University
D – DOD
A – Other Government Agency
C – Industrial Corporations
I – International

EXPERIMENT

A – Aeronomy
E – Energetic Particles and Fields
I – Ionospheric Physics
S – Solar Physics
G – Galactic Astronomy
R – Radio Astronomy
B – Biological
P – Special Projects
T – Test and Support

FIRING SITES

ASC Ascension Island
AUS Australia
EGL Eglin
FC Fort Churchill
IND India
NOR Norway
PAK Pakistan
PMR Pacific Missile Range
Pt. A Point Arguello
SWE Sweden
WI Wallops Island

PART III

NASA SOUNDING ROCKET FLIGHTS

NASA NO.	FIRING DATE	FIRING SITE	FIRING PERF*	PRINCIPAL NASA SCIENTIST / COOPERATING INVESTIGATOR	EXPERIMENT	RESULTS*
				AERONOMY		
	1960					
4.09 GA	April 29	WI	S	Horowitz	Atmospheric Composition	S
10.03 GA	June 16	WI	P	Nordberg	Grenade	X
10.04 GA	July 9	WI	S	Nordberg	Grenade	S
10.01 GA	14	WI	S	Nordberg	Grenade	X
4.14 GA	Nov. 15	WI	S	Taylor	Atmospheric Composition	S
10.06 GA	Dec. 14	WI	S	Nordberg	Grenade	S
	1961					
10.07 GA	Feb. 14	WI	S	Nordberg	Grenade	S
10.08 GA	17	WI	P	Nordberg	Grenade	S
10.33 GA	April 5	WI	S	Nordberg	Grenade	P
10.34 GA	27	WI	X	Smith	Grenade	X
10.02 GA	May 5	WI	S	Smith	Grenade	S
10.28 GA	6	WI	S	Smith	Grenade	S
10.29 GA	9	WI	S	Smith	Grenade	P
10.30 GA	July 13	WI	S	Smith	Grenade	S
10.31 GA	14	WI	S	Smith	Grenade	S
10.32 GA	20	WI	S	Smith	Grenade	S
10.35 GA	21	WI	S	Smith	Grenade	X
10.36 GA	Sep. 16	WI	P	Smith	Grenade	P
10.37 GA	17	WI	S	Smith	Grenade	X
1.08 GA	23	FC	S	Varian-Martin	Atmospheric Structure	S
1.09 GA	30	FC	S	Varian-Martin	Atmospheric Structure	S
8.23 GA	Oct. 10	WI	S	Taylor	Ionosphere	S
1.10 GA	15	FC	S	Varian-Martin	Atmospheric Structure	S
1.07 GA	17	FC	S	Varian-Martin	Atmospheric Structure	S
1.11 GA	Nov. 1	FC	S	Varian-Martin	Atmospheric Structure	S
1.12 GA	5	FC	S	Varian-Martin	Atmospheric Structure	S
10.64 GA	Dec. 21	WI	S	U/M-Spencer	Atmospheric Structure	S
	1962					
10.38 GA	Mar. 2	WI	S	Smith	Grenade	S
10.39 GA	2	WI	S	Smith	Grenade	S
4.18 GA	19	WI	X	U/M-Spencer	Atmospheric Structure	X
10.40 GA	23	WI	S	Smith	Grenade	S
10.41 GA	28	WI	S	Smith	Grenade	S
10.42 GA	April 17	WI	S	Smith	Grenade	S
5.04 GA	May 3	WI	P	Taylor	Atmospheric Structure	S

*S–Successful
P–Partial Success
X–Unsuccessful
} . . Subject to Interpretation

PART III
NASA SOUNDING ROCKET FLIGHTS (Cont.)

NASA NO.	FIRING			PRINCIPAL NASA SCIENTIST / COOPERATING INVESTIGATOR	EXPERIMENT	RESULTS*
	DATE	SITE	PERF*			
10.43 GA	June 7	WI	S	Smith	Grenade	S
10.44 GA	8	WI	S	Smith	Grenade	S
10.65 GA	Nov. 16	FC	X	Smith	Grenade	X
6.06 GA	20	WI	S	Brace	Thermosphere Probe	S
10.45 GA	Dec. 1	WI	S	Smith	Grenade	S
10.68 GA	1	FC	S	Smith	Grenade	X
10.46 GA	4	WI	S	Smith	Grenade	X
10.67 GA	4	FC	X	Smith	Grenade	S
10.47 GA	6	WI	S	Smith	Grenade	S
10.66 GA	6	FC	S	Smith	Grenade	S
	1963					
10.48 GA	Feb. 20	WI	S	Smith	Grenade	S
10.58 GA	20	FC	S	Smith	Grenade	S
10.53 GA	28	WI	S	Smith	Grenade	S
10.59 GA	28	FC	S	Smith	Grenade	S
10.54 GA	Mar. 9	WI	S	Smith	Grenade	S
10.60 GA	9	FC	S	Smith	Grenade	S
6.07 GA	April 18	WI	S	Brace	Thermosphere Probe	S
10.55 GA	Dec. 7	WI	S	Smith	Grenade	S
	1964					
10.61 GA	Jan. 24	WI	S	Smith	Grenade	S
10.86 GA	24	FC	X	Smith	Grenade	X
6.09 GA	29	WI	S	Brace	Thermosphere Probe	S
10.71 GA	29	WI	S	Smith	Grenade	S
10.89 GA	29	FC	S	Smith	Grenade	S
10.81 GA	29	ASC	S	Smith	Grenade	S
10.62 GA	Feb. 4	WI	S	Smith	Grenade	S
10.87 GA	5	FC	S	Smith	Grenade	S
10.63 GA	5	WI	S	Smith	Grenade	S
10.136 GA	13	WI	S	Smith	Grenade	S
10.88 GA	13	FC	S	Smith	Grenade	S
10.82 GA	13	ASC	S	W. Smith	Grenade	S
10.88 GA	13	FC	S	W. Smith	Grenade	S
10.137 GA	Mar. 7	WI	S	W. Smith	Grenade	S
10.73 GA	April 18	FC	S	W. Smith	Grenade	S
10.83 GA	18	WI	S	W. Smith	Grenade	S
4.113 GA	21	WI	X	Berg-Aikin	Astrochemistry	X
6.10 GA	July 29	FC	S	Brace	Thermosphere Probe	S
10.114 GA	Aug. 5	ASC	S	W. Smith	Grenade	X
10.138 GA	7	SWE	S	W. Smith	Grenade	S
10.78 GA	7	WI	S	W. Smith	Grenade	S
10.104 GA	8	FC	S	W. Smith	Grenade	S
10.139 GA	12	SWE	S	W. Smith	Grenade	X
10.84 GA	12	WI	S	W. Smith	Grenade	S
10.105 GA	12	FC	S	W. Smith	Grenade	S
10.140 GA	16	SWE	S	W. Smith	Grenade	S
10.85 GA	16	WI	S	W. Smith	Grenade	S
10.115 GA	16	ASC	S	W. Smith	Grenade	S
10.116 GA	16	ASC	S	W. Smith	Grenade	S
10.141 GA	17	SWE	S	W. Smith	Grenade	S
10.106 GA	18	FC	S	W. Smith	Grenade	S
10.113 GA	18	WI	S	W. Smith	Grenade	S
10.132 GA	Nov. 3	WI	S	W. Smith	Grenade	X
10.107 GA	5	WI	S	W. Smith	Grenade	S
10.133 GA	6	WI	S	W. Smith	Grenade	S
10.134 GA	6	WI	S	W. Smith	Grenade	S

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PART III
NASA SOUNDING ROCKET FLIGHTS (Cont.)

NASA NO.	FIRING			PRINCIPAL NASA SCIENTIST / COOPERATING INVESTIGATOR	EXPERIMENT	RESULTS*
	DATE	SITE	PERF*			
10.135 GA	Nov. 6	WI	S	W. Smith	Grenade	S
4.45 GA	16	WI	S	Brace	Thermosphere Probe	S
10.117 GA	19	WI	S	W. Smith	Grenade	S
~~4.83 GA~~	Dec. 1	WI	S	Hennes	Middle UV Airglow	S
4.132 GA-GI	16	WI	S	Burg	Micrometeorites	S
	1961					
10.72 NA	Nov. 18	WI	S	LRC/Hord	Airglow	S
	1962					
10.79 NA	April 5	WI	S	LRC/Potter	Ozone	S
1.13 NA	Sep. 6	WI	S	JPL/Barth	U. V. Airglow	S
1.14 NA	Nov. 20	WI	X	JPL/Barth	U. V. Airglow	X
	1963					
10.80 NA	Jan. 17	WI	S	LRC/Potter	Ozone	S
10.92 NA	Sep. 25	WI	S	LRC	Chemical Release	S
10.93 NA	25	WI	S	LRC	Chemical Release	S
14.102 NA	Oct. 9	WI	S	LRC/Potter	Chemical Release	S
14.103 NA	10	WI	S	LRC/Potter	Chemical Release	S
4.85 NA	Nov. 12	WI	S	JPL/Barth	Airglow	S
	1964					
4.86 NA	April 14	WI	X	Jet Propulsion Lab.	Airglow	X
4.115 NA	Sep. 18	WI	S	JPL/Barth	Dayglow	S
4.118 NA	Nov. 16	WI	S	Ames	Micrometeoroid	X
	1960					
10.09 UA	Nov. 2	WI	S	U/M-Dubin	Atmospheric Composition	X
10.10 UA	16	WI	S	U/M-Dubin	Atmospheric Composition	X
	1961					
10.50 UA	June 6	WI	S	U/M-Dubin	Atmospheric Structure	S
10.56 UA	9	WI	S	U/M-Dubin	Atmospheric Composition	X
10.57 UA	July 26	WI	S	U/M-Dubin	Atmospheric Composition	X
	1962					
10.90 UA	Feb. 20	WI	S	U/M-Dubin	Atmospheric Composition	X
10.91 UA	May 18	WI	S	U/M-Dubin	Atmospheric Composition	S
14.19 UA	June 6	WI	S	U/M-Spencer	Atmospheric Structure	S
14.20 UA	Dec. 1	WI	S	U/M-Spencer	Atmospheric Structure	S
4.74 UA	13	WI	X	JHU/Dubin	Airglow	X
	1963					
4.73 UA	Jan. 29	WI	X	JHU/Dubin	Airglow	X
14.08 UA	Mar. 28	WI	S	U/M-Dubin	Atmospheric Composition	S
14.09 UA	28	WI	S	U/M-Dubin	Atmospheric Composition	X
4.98 UA	May 7	WI	S	JHU/Dubin	Airglow	S
4.75 UA	July 20	FC	X	JHU/Dubin	Airglow	X
10.75 UA	Aug. 2	WI	S	U/M-Holtz	Atmospheric Density	S
4.76 UA	Nov. 12	WI	S	JHU/Dubin	Airglow	S
14.10 UA	26	WI	S	U/M-Dubin	Atmospheric Composition	S
10.131 UA	26	WI	S	U/M-Dubin	Atmospheric Density	S
14.21 UA	Dec. 7	WI	S	U/M-W. Smith	Atmospheric Structure	S

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PART III

NASA SOUNDING ROCKET FLIGHTS (Cont.)

NASA NO.	FIRING			PRINCIPAL NASA SCIENTIST / COOPERATING INVESTIGATOR	EXPERIMENT	RESULTS*
	DATE	SITE	PERF*			
	1964					
14.22 UA	Feb. 4	ASC	S	U/M-W. Smith	Atmospheric Structure	S
4.124 UA	Feb. 27	FC	P	JHU/Dubin	Aurora	S
14.24 UA	April 15	ASC	S	U/M-W.Smith	Atmospheric Structure	S
14.23 UA	15	ASC	S	U/M-W. Smith	Atmospheric Structure	S
10.142 UA	17	WI	S	U/M-Dubin	Atmospheric Density	S
4.125 UA	Dec. 17	WI	S	JHU/Dubin	Airglow	S
8.34 UA	Nov. 5	WI	S	JHU/Dubin	Airglow	S
14.233 UA	17	SHIP	S	U. of Mich./Dubin	Atmospheric Density	S
10.153 UA	17	SHIP	S	U. of Mich./Dubin	Atmospheric Density	S
14.29 UA	19	SHIP	X	U. of Mich./W. Smith	Pilot Probe	X
	1963					
14.140 DA	May 18	EGL	S	AFCRL/Ga. Tech.	Sodium Vapor	S
14.141 DA	18	EGL	S	AFCRL/Ga. Tech.	Sodium Vapor	S
10.130 DA	22	EGL	S	AFCRL/Ga. Tech.	Sodium Vapor	S
	1964					
8.31 DA	Jan. 17	WI	S	NRL/Dubin	Composition Airglow	S
14.54 DA	May 28	WI	X	ARCRL/W. Smith	Air Sampling	X
14.55 DA	Aug. 6	SWE	S	AFCRL/W. Smith	Air Sampling	X
14.56 DA	12	SWE	S	AFCRL/W. Smith	Air Sampling	S
14.57 DA	16	SWE	S	AFCRL/W. Smith	Air Sampling	S
14.58 DA	17	SWE	S	AFCRL/W. Smith	Air Sampling	S
14.55 DA	6	SWE	S	AFCRL/W. Smith	Air Sampling	X
14.56 DA	12	SWE	S	AFCRL/W. Smith	Air Sampling	S
14.57 DA	16	SWE	S	AFCRL/W. Smith	Air Sampling	S
14.58 DA	17	SWE	S	AFCRL/W. Smith	Air Sampling	S
	1962					
14.45 AA	Dec. 1	EGL	S	AFCRL/Dubin	Sodium Vapor	X
14.46 AA	3	EGL	S	AFCRL/Dubin	Sodium Vapor	P
	1959					
3.13 CA	Aug. 17	WI	S	GCA/Dubin	Sodium Vapor	S
3.14 CA	19	WI	X	GCA/Dubin	Sodium Vapor	X
3.15 CA	Nov. 18	WI	S	GCA/Dubin	Sodium Vapor	S
3.16 CA	19	WI	S	GCA/Dubin	Sodium Vapor	X
3.17 CA	20	WI	S	GCA/Dubin	Sodium Vapor	X
	1960					
3.23 CA	May 24	WI	X	GCA/Dubin	Sodium Vapor	X
3.24 CA	25	WI	S	GCA/Dubin	Sodium Vapor	S
10.05 CA	Sep. 20	WI	S	Nordberg	Grenade	X
8.04 CA	Nov. 10	WI	S	Lockheed/Dubin	Ionosphere	P
10.11 CA	Dec. 9	WI	X	GCA/Dubin	Sodium Vapor	X
10.12 CA	9	WI	S	GCA/Dubin	Sodium Vapor	S
8.05 CA	10	WI	S	GCA/Dubin	Sodium Vapor	S
	1961					
3.05 CA	April 19	WI	S	GCA/Dubin	Sodium Vapor	S
3.06 CA	21	WI	S	GCA/Dubin	Sodium Vapor	S
3.07 CA	21	WI	X	GCA/Dubin	Sodium Vapor	X
3.08 CA	21	WI	S	GCA/Dubin	Sodium Vapor	S
8.06 CA	Sep. 13	WI	S	GCA/Smith	Sodium Vapor	S
8.22 CA	13	WI	S	GCA/Smith	Sodium Vapor	S
3.09 CA	16	WI	X	GCA/Smith	Sodium Vapor	X

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PART III

NASA SOUNDING ROCKET FLIGHTS (Cont.)

NASA NO.	FIRING			PRINCIPAL NASA SCIENTIST / COOPERATING INVESTIGATOR	EXPERIMENT	RESULTS*
	DATE	SITE	PERF*			
3.18 CA	Sep. 16	WI	S	GCA/Smith	Sodium Vapor	S
3.19 CA	17	WI	S	GCA/Smith	Sodium Vapor	S
	1962					
10.100 CA	Mar. 1	WI	S	GCA/Smith	Sodium Vapor	S
10.101 CA	2	WI	S	GCA/Smith	Sodium Vapor	S
10.102 CA	23	WI	S	GCA/Smith	Sodium Vapor	S
10.103 CA	27	WI	S	GCA/Smith	Sodium Vapor	S
3.20 CA	April 17	WI	S	GCA/Smith	Sodium Vapor	S
3.21 CA	June 7	WI	S	GCA/Smith	Sodium Vapor	S
3.22 CA	7	WI	X	GCA/Smith	Sodium Vapor	X
14.30 CA	Aug. 23	WI	P	Lockheed/Depew	Atmospheric Structure	X
14.16 CA	Nov. 7	WI	S	GCA/Smith	Sodium Vapor	S
14.17 CA	30	WI	S	GCA/Smith	Sodium Vapor	S
14.18 CA	Dec. 5	WI	S	GCA/Smith	Sodium Vapor	P
	1963					
3.11 CA	Feb. 18	WI	X	GCA/Smith	Sodium Vapor	X
14.35 CA	20	WI	S	GCA/Smith	Sodium Vapor	S
14.39 CA	21	WI	S	GCA/Smith	Sodium Vapor	S
14.110 CA	May 8	WI	S	Lockheed/Bourdeau	Massenfilter	X
14.13 CA	22	FC	S	GCA/Dubin	Sodium Vapor	S
14.14 CA	22	FC	S	GCA/Dubin	Sodium Vapor	S
14.15 CA	23	FC	S	GCA/Dubin	Sodium Vapor	S
14.40 CA	24	WI	S	GCA/Dubin	Sodium Vapor	S
14.41 CA	24	WI	S	GCA/Dubin	Sodium Vapor	X
14.42 CA	25	WI	S	GCA/Dubin	Sodium Vapor	S
	1964					
14.38 CA	Jan. 15	WI	X	GCA/Smith	Sodium Vapor	X
14.106 CA	15	WI	P	GCA/Smith	Sodium Vapor	S
14.125 CA	16	WI	S	GCA/Smith	Sodium Vapor	S
14.126 CA	16	WI	S	GCA/Smith	Sodium Vapor	S
14.49 CA	July 15	WI	S	GCA/W. Smith	Sodium Vapor	S
14.50 CA	15	WI	S	GCA/W. Smith	Sodium Vapor	S
14.51 CA	15	WI	S	GCA/W. Smith	Sodium Vapor	S
14.52 CA	15	WI	S	GCA/W. Smith	Sodium Vapor	S
14.195 CA	Oct. 7	WI	S	GCA/Dubin	Luminous Cloud Ionospheres	S
8.03 CA	8	WI	S	Lockheed/Dubin	Ion Composition	S
14.194 CA	8	WI	S	GCA/Dubin	Luminous Cloud Ionospheres	S
14.197 CA	Nov. 1	FC	S	GCA/Dubin	Luminous Cloud Ionospheres	S
14.114 CA	10	SHIP	S	GCA/W. Smith	Sodium Vapor	S
14.53 CA	10	WI	S	GCA/W. Smith	Sodium Vapor	S
14.115 CA	11	SHIP	S	GCA/W. Smith	Sodium Vapor	S
14.112 CA	11	WI	S	GCA/W- Smith	Sodium Vapor	S
14.116 CA	12	SHIP	S	GCA/W. Smith	Sodium Vapor	S
14.113 CA	12	WI	S	GCA/W. Smith	Sodium Vapor	X
	1962					
Rehbar 1**	June 7	PAK	S	Mustafa	Sodium Vapor	X
Rehbar 2**	11	PAK	S	Mustafa	Sodium Vapor	X
	1963					
10.77 IA	May 16	PAK	S	Pakistan	Sodium Vapor	X
14.137 IA	20	Italy	S	Italy	Sodium Vapor	S
14.138 IA	21	Italy	S	Italy	Sodium Vapor	S
14.139 IA	21	Italy	S	Italy	Sodium Vapor	S

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} - - Subject to Interpretation

PART III
NASA SOUNDING ROCKET FLIGHTS (Cont.)

NASA NO.	FIRING DATE	FIRING SITE	FIRING PERF*	PRINCIPAL NASA SCIENTIST / COOPERATING INVESTIGATOR	EXPERIMENT	RESULTS*
14.128 IA	Nov. 21	IND	S	India/Dubin	Sodium Vapor	P
	1964					
14.129 IA	Jan. 8	IND	S	India/Dubin	Sodium Vapor	S
14.130 IA	12	IND	S	India/Dubin	Sodium Vapor	S
14.134 IA	Mar. 29	PAK	S	Pakistan	Sodium Vapor	X
14.131 IA	Nov. 6	IND	S	India	Sodium Vapor	S
14.204 IA	Nov. 9	IND	S	India	Sodium Vapor	S
14.205 IA	10	IND	S	India	Sodium Vapor	S
14.135 IA	30	PAK	S	Pakistan	Sodium Vapor	S
14.136 IA	Dec. 1	PAK	S	Pakistan	Sodium Vapor	S
				ENERGETIC PARTICLES AND FIELDS		
	1960					
10.17 GE	June 6	FC	S	Fichtel	SBE	S
8.07 GE	30	WI	X	Heppner	Magnetic Field	S
10.18 GE	July 22	FC	X	Fichtel	SBE	S
10.19 GE	Sep. 3	FC	S	Fichtel	SBE	S
10.20 GE	3	FC	S	Fichtel	SBE	S
11.01 GE	19	PMR	S	Naugle	NERV 1	S
10.21 GE	27	FC	S	Fichtel	SBE	S
10.22 GE	Nov. 11	FC	S	Fichtel	SBE	S
10.23 GE	11	FC	S	Fichtel	SBE	P
10.24 GE	12	FC	S	Fichtel	SBE	S
10.15 GE	12	FC	S	Fichtel	SBE	S
10.16 GE	13	FC	S	Fichtel	SBE	S
10.13 GE	16	FC	S	Fichtel	SBE	S
10.14 GE	17	FC	S	Fichtel	SBE	S
10.26 GE	18	FC	S	Fichtel	SBE	S
10.27 GE	18	FC	S	Fichtel	SBE	S
8.08 GE	Dec. 12	WI	S	Heppner	Magnetic Fields	S
	1961					
10.76 GE	Dec. 10	FC	S	Ogilvie-Fichtel	Cosmic Ray	S
	1963					
4.91 GE	Sep. 4	FC	S	Fichtel	Heavy Cosmic Rays	S
	1964					
14.43 GE	Feb. 20	FC	S	Evans	Aurora	P
14.44 GE	29	FC	S	Evans	Aurora	P
14.118 GE	Mar. 24	FC	S	Evans	Aurora	S
14.120 GE	25	FC	S	Evans	Aurora	X
14.119 GE	26	FC	S	Evans	Aurora	P
14.155 GE	June 10	WI	S	N. Davis	Magnetic Fields	S
14.156 GE	25	WI	S	N. Davis	Magnetic Fields	S
14.157 GE	26	WI	S	N. Davis	Magnetic Fields	S
4.107 GE	July 23	FC	S	Fichtel	Heavy Cosmic Rays	P
4.108 GE	25	FC	S	Fichtel	Heavy Cosmic Rays	S
14.158 GE	Oct. 7	WI	X	N. Davis	Magnetic Fields	X
14.159 GE	8	WI	S	N. Davis	Magnetic Fields	S
	1960					
4.16 UE	Aug. 23	WI	S	NYU/Meredith	Cosmic Ray	S

*S–Successful
P–Partial Success
X–Unsuccessful
} - - Subject to Interpretation

PART III

NASA SOUNDING ROCKET FLIGHTS (Cont.)

NASA NO.	FIRING			PRINCIPAL NASA SCIENTIST / COOPERATING INVESTIGATOR	EXPERIMENT	RESULTS*
	DATE	SITE	PERF*			
	1961					
14.03 UE	July 14	WI	S	UNH/Heppner	Magnetic Field	S
14.04 UE	14	WI	S	UNH/Heppner	Magnetic Field	S
14.05 UE	20	WI	S	UNH/Heppner	Magnetic Field	S
	1963					
11.06 UE	Feb. 12	PMR	S	U. Minn./Cline	Electron Spect.	S
14.06 UE	Sep. 9	WI	S	UNH/Schardt	Electrojet	S
	1964					
14.150 UE	Jan. 15	WI	P	Rice/Schardt	Sodium Vapor	X
14.79 UE	25	IND	S	UNH/Schardt	Equitorial Electrojet	S
14.180 UE	27	IND	S	UNH/Schardt	Equitorial Electrojet	S
14.81 UE	29	IND	S	UNH/Schardt	Equitorial Electrojet	S
14.82 UE	31	IND	S	UNH/Schardt	Equitorial Electrojet	S
14.151 UE	Mar. 18	FC	S	Rice/Schardt	Aurora	S
14.152 UE	20	FC	S	Rice/Schardt	Aurora	S
14.153 UE	23	FC	S	Rice Schardt	Aurora	S
14.121 UE	April 11	FC	S	Alaska/Schardt	Aurora	S
14.122 UE	15	FC	S	Alaska/Schardt	Aurora	X
14.123 UE	22	FC	S	Alaska/Schardt	Aurora	S
14.154 UE	July 9	WI	S	Rice/Schardt	Airglow	S
14.60 UE	Dec. 7	WI	S	UNH/Schardt	Energetic Particles	X
				IONOSPHERIC PHYSICS		
	1959					
4.08 GI	Sep. 11	FC	S	Jackson	Ionosphere	S
4.07 GI	14	FC	S	Jackson	Ionosphere	S
	1960					
1.01 GI	Nov. 23	FC	S	Whipple	Ionosphere	S
1.02 GI	27	FC	S	Whipple	Ionosphere	S
	1961					
8.10 GI	April 27	WI	S	Jackson	Ionosphere	P
8.09 GI	June 13	WI	S	Jackson	Ionosphere	P
10.74 GI	Dec. 21	WI	S	Kane	Ionosphere	S
	1962					
10.110 GI	April 26	WI	S	Serbu	Electron Temperature	S
8.21 GI	May 3	WI	S	Serbu	ELF Electron Trap	S
10.112 GI	16	WI	S	Serbu	Electron Temperature	S
10.111 GI	17	WI	S	Serbu	Electron Temperature	S
14.12 GI	June 15	WI	S	Kane	Ionosphere	S
K63-1**	July 27	SWE	S	Martin-Läf/Witt	Grenade	S
K63-2**	29	SWE	S	Martin-Läf/Witt	Grenade	S
K63-3**	Aug. 1	SWE	S	Martin-Läf/Witt	Grenade	S
K63-4**	7	SWE	S	Fichtel	Heavy Cosmic Rays	S
K62-1**	7	SWE	S	Ortner/Witt	Air Sample	S
K62-3**	11	SWE	S	Ortner/Witt	Air Sample	S
K62-4**	11	SWE	S	Ortner/Witt	Air Sample	P
K62-5**	31	SWE	S	Ortner/Witt	Air Sample	X
14.31 GI	Oct. 16	WI	S	Bauer	Ionosphere	S
14.32 GI	Dec. 1	WI	S	Bauer	Ionosphere	S
	1963					
14.107 GI	Mar. 8	WI	S	Whipple	Ionosphere	P

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PART III
NASA SOUNDING ROCKET FLIGHTS (Cont.)

NASA NO.	FIRING			PRINCIPAL NASA SCIENTIST / COOPERATING INVESTIGATOR	EXPERIMENT	RESULTS*
	DATE	SITE	PERF*			
14.108 GI	April 9	WI	S	Kane	D-Region	S
4.44 GI	23	WI	S	Bauer	Electron Density	S
8.14 GI	July 2	WI	S	Bauer	Ionosphere	S
6.08 GI	20	WI	S	Brace	Thermosphere Probe	S
4.65 GI	Sep. 25	WI	S	Serbu/Hirao	Ionosphere	S
4.64 GI	28	WI	S	Serbu/Hirao	Ionosphere	S
8.18 GI	29	WI	S	Bauer	Ionosphere	
14.37 GI	Dec. 13	WI	P	Whipple	Ionosphere	
	1964					
12.03 GI	April 15	WI	S	Guidotti	Ionosphere	S
4.113 GI	21	WI	X	Berg-Aikin	Ionosphere	X
14.33 GI	June 3	WI	S	Bauer	Ionosphere	P
14.127 GI	July 16	WI	S	Stone	Ionosphere	S
14.34 GI	Aug. 26	WI	S	Bauer	Ionosphere	S
8.24 GI-II	Oct. 19	WI	S	Serbu	Ionosphere	P
14.117 GI	Nov. 23	WI	S	Bauer	Ionosphere	S
14.209 GI	Dec. 16	WI	S	Aikin	Ionosphere	S
	1960					
6.01 UI	Mar. 16	FC	S	U/M Bourdeau	Ionosphere	S
3.10 UI	16	FC	X	U/M Bourdeau	Ionosphere	X
6.02 UI	June 15	FC	S	U/M Bourdeau	Ionosphere	S
6.03 UI	Aug. 3	WI	S	U/M Bourdeau	Ionosphere	S
	1961					
6.04 UI	Mar. 26	WI	S	U/M Bourdeau	Ionosphere	S
6.05 UI	Dec. 22	WI	S	U/M Wright	Ionosphere	S
	1963					
4.58 UI	April 3	WI	S	Stanford/Bourdeau	Ionosphere	S
6.03 UI	July 10	WI	S	Stanford/Bourdeau	Ionosphere	S
	1964					
14.143 UI	April 16	WI	S	U. of Ill./Schardt	Ionosphere	S
14.144 UI	July 15	WI	S	U. of Ill./Schardt	Ionosphere	S
14.145 UI	15	WI	S	U. of Ill./Schardt	Ionosphere	S
14.146 UI	15	WI	S	U. of Ill./Schardt	Ionosphere	S
14.147 UI	Nov. 10	WI	S	U. of Ill./Schardt	IQSY Ionosphere	S
14.149 UI	19	WI	S	U. of Ill./Schardt	IQSY Ionosphere	S
14.148 UI	19	SHIP	S	U. of Ill./Schardt	IQSY Ionosphere	S
	1963					
14.36 DI	Oct. 7	FC	S	BRL/Bourdeau	Ionosphere	P
	1964					
14.104 DI	Nov. 5	FC	S	BRL/Bourdeau	Ionosphere	S
8.19 DI	5	FC	S	BRL/Bourdeau	Ionosphere	S
14.105 DI	7	FC	S	BRL/Bourdeau	Ionosphere	S
8.20 DI	7	FC	S	BRL/Bourdeau	Ionosphere	S
	1961					
8.15 AI	June 24	WI	S	CRPL/AIL-Jackson	Ionosphere	S
8.17 AI	Oct. 14	WI	S	Jackson	Ionosphere	S

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PART III
NASA SOUNDING ROCKET FLIGHTS (Cont.)

NASA NO.	FIRING			PRINCIPAL NASA SCIENTIST	COOPERATING INVESTIGATOR	EXPERIMENT	RESULTS*
	DATE	SITE	PERF*				
	1962						
8.16 AI	Feb. 7	WI	S		Jackson	Ionosphere	X
	1960						
3.12 CI	Aug. 22	WI	X		GCA/Bourdeau	Langmuir Probe	X
10.25 CI	Dec. 8	WI	S		GCA/Bourdeau	Langmuir Probe	S
	1961						
10.51 CI	July 18	WI	S		GCA/Wright	Langmuir Probe	S
10.52 CI	Oct. 27	WI	S		GCA/Bourdeau	Langmuir Probe	S
	1962						
10.99 CI	Nov. 7	WI	S		GCA/Bourdeau	Ionosphere	S
10.108 CI	30	WI	S		GCA/Bourdeau	Ionosphere	S
10.109 CI	Dec. 5	WI	S		GCA/Bourdeau	Ionosphere	S
	1963						
14.86 CI	Feb. 27	WI	S		GCA/Bourdeau	Ionosphere	S
14.87 CI	Mar. 28	WI	P		GCA/Bourdeau	Ionosphere	S
14.88 CI	July 14	FC	P		GCA/Bourdeau	Ionosphere	P
14.89 CI	20	FC	X		GCA/Bourdeau	Eclipse Ionosphere	X
14.90 CI	20	FC	X		GCA/Bourdeau	Eclipse Ionosphere	X
14.91 CI	20	FC	S		GCA/Bourdeau	Eclipse Ionosphere	S
14.92 CI	20	FC	S		GCA/Bourdeau	Eclipse Ionosphere	S
14.93 CI	20	FC	S		GCA/Bourdeau	Eclipse Ionosphere	S
14.94 CI	20	FC	S		GCA/Bourdeau	Eclipse Ionosphere	S
	1959						
4.02 II	Sep. 17	FC	S		DRTE-Jackson	Ionosphere	S
4.03 II	20	FC	P		DRTE-Jackson	Ionosphere	X
	1961						
8.13 II	June 15	WI	S		DRTE-Jackson	Antenna Test	S
	1962						
4.79 II	Nov. 16	WI	X		AUS/Cartwright	Ionosphere	X
4.80 II	Dec. 11	WI	X		AUS/Cartwright	Ionosphere	X
Ferdinand III	11	NOR	S		Kane	Ionosphere	S
Ferdinand II	14	NOR	S		Norway	NASA T/M only	S
	1963						
4.96 II	Mar. 12	WI	S		AUS/Cartwright	VLF	S
4.97 II	May 9	WI	S		AUS/Cartwright	VLF	S
Ferdinand V	Aug. 8	NOR	S		Kane	Ionosphere	X
Ferdinand IV	11	NOR	S		Kane	Ionosphere	S
4.93 II	Oct. 17	WI	S		France/Shea	Ionosphere	S
4.94 II	31	WI	S		France/Shea	Ionosphere	S
	1964						
Ferdinand VI	Mar. 12	NOR	S		Kane	Ionosphere	S
Ferdinand VII	15	NOR	S		Kane	Ionosphere	S
Ferdinand VIII	19	NOR	S		Kane	Ionosphere	S
1 64-1 II	Dec. 1	ARG	S		Argentina/Bauer	Ionosphere	S
1 64-2 II	4	ARG	S		Argentina/Bauer	Ionosphere	S

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PART III
NASA SOUNDING ROCKET FLIGHTS (Cont.)

NASA NO.	FIRING			PRINCIPAL NASA SCIENTIST / COOPERATING INVESTIGATOR	EXPERIMENT	RESULTS*
	DATE	SITE	PERF*			
				SOLAR PHYSICS		
	1960					
3.01 GS	Mar. 1	WI	S	Hallam	Solar Study	X
3.02 GS	3	WI	S	Hallam	Solar Study	X
3.03 GS	April 27	WI	X	Hallam	Solar Study	X
3.04 GS	May 25	WI	X	Hallam	Solar Study	X
	1961					
4.25 GS	Sep. 30	WI	S	Behring	Solar Studies	S
	1963					
4.77 GS	July 20	WI	S	Hallam-Wolff	Solar Studies	X
4.78 GS	Oct. 1	WI	S	Hallam	Solar Studies	P
4.33 GS	15	WI	S	Money	Solar Studies	S
4.116 GS	Oct. 30	WI	S	Muney	Solar Studies	S
	1962					
4.23 US	June 24	WI	S	U. Colo./Lindsay	Sunfollower	P
4.21 US	Oct. 27	WI.	S	Harvard/Lindsay	Solar	X
	1963					
4.22 US	Sep. 6	WI	S	Harvard/Lindsay	Solar Studies	S
	1963					
4.61 AS	June 20	WI	S	NRL/Packer	Coronograph	P
4.62 AS	28	WI	S	NRL/Packer	Coronograph	P
				GALACTIC ASTRONOMY		
	1960					
4.04 GG	April 27	WI	P	Kupperian	Stellar Fluxes	P
4.05 GG	May 27	WI	S	Boggess	Stellar Fluxes	P
4.06 GG	June 24	WI	S	Boggess	Stellar Fluxes	S
4.11 GG	Nov. 22	WI	S	Stecher	Stellar Spectra	S
	1961					
4.34 GG	Mar. 31	WI	P	Boggess	Stellar Fluxes	P
9.01 GG	Sep. 18	AUS	S	Boggess	Stellar Photo	S
9.02 GG	Oct. 4	AUS	S	Boggess	Stellar Photo	S
9.03 GG	Nov. 1	AUS	S	Boggess	Stellar Photo	P
9.04 GG	20	AUS	S	Boggess	Stellar Photo	S
	1962					
4.35 GG	Feb. 7	WI	X	Stecher	Stellar Spectra	X
4.36 GG	Sep. 22	WI	S	Stecher	Stellar Photo	S
	1963					
4.30 GG	Mar. 28	WI	S	Boggess	Stellar Spectra	S
4.37 GG	July 19	WI	S	Stecher	Stellar Spectra	S
4.29 GG	23	WI	S	Stecher	Stellar Spectra	S
4.31 GG	Oct. 10	WI	X	Boggess	Stellar Spectra	X
	1964					
4.15 GG	April 3	WI	S	Boggess	Stellar Spectra	X
4.81 GG	10	WI	X	Boggess	Stella Spectra	X
4.82 GG	Aug. 11	WI	S	Boggess	Stellar Spectra	X
4.126 GG	22	WI	P	Boggess	Stellar Spectra	S

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X–Unsuccessful

PART III
NASA SOUNDING ROCKET FLIGHTS (Cont.)

NASA NO.	FIRING			PRINCIPAL NASA SCIENTIST / COOPERATING INVESTIGATOR	EXPERIMENT	RESULTS*
	DATE	SITE	PERF*			
4.109 GG	Nov. 7	WI	S	Stecher	Stellar Spectra	S
4.110 GG	14	WI	S	Stecher	Stellar Spectra	S
	1962					
4.54 UG	Sep. 30	WI	S	U. of Wisc./Kupperian	Stellar Studies	S
	1964					
4.55 UG	Sep. 2	WI	S	U. of Wisc./Kupperian	Stellar Studies	S
4.52 UG	Nov. 3	WI	P	Princeton	Stellar Spectra	P
	1962					
4.69 CG	Sep. 30	WI	S	Lockheed/Dubin	Night Sky Mapping	S
	1963					
4.70 CG	Mar. 16	WI	S	Lockheed/Depew	Stellar Spectra	S
	1964					
4.122 CG	Aug. 29	WI	S	AS&E/Roman	Stellar Studies	S
4.120 CG	Oct. 2	WI	S	Lockheed/Roman	Stellar X-ray	S
4.123 CG	Oct. 27	WI	S	AS&E/Roman	Stellar Studies	S
				RADIO AND ASTRONOMY		
	1964					
8.33 GR	Oct. 23	WI	S	Stone	Radio Astronomy	S
	1962					
11.02 UR	Sep. 22	WI	S	U. of Mich./Haddock	Radio Astronomy	S
				BIOLOGICAL		
	1961					
11.04 GB	Nov. 15	Pt. A	S	Campbell	BIOS 1	X
11.05 GB	18	Pt. A	P	Campbell	BIOS 1	X
				SPECIAL PROJECTS		
	1960					
1.03 GP	Sep. 15	FC	S	Baumann	AMPP	S
1.05 GP	24	FC	S	Baumann	AMPP	P
4.43 GP	Oct. 5	FC	S	NRL-Baumann	AMPP	S
	1961					
1.04 GP	May 17	FC	S	Baumann	AMPP	P
1.06 GP	19	FC	S	Baumann	AMPP	S
	1964					
4.13 GP	Sep. 26	WI	S	Busse	Multiple piggyback	S
	1961					
4.38 NP	Feb. 5	WI	S	LRC/Gold	Hydrogen Zerog	P
4.39 NP	April 21	WI	S	LRC/Gold	Hydrogen Zerog	S
4.42 NP	Aug. 12	WI	S	LRC/Plohr	Hydrogen Zerog	P
4.40 NP	Oct. 18	WI	S	LRC/Regetz	Hydrogen Zerog	S
	1962					
4.41 NP	Feb. 17	WI	S	LRC/Dillon	Hydrogen Zerog	S
4.46 NP	May 8	WI	P	JPL/Brown	Radar	X
4.26 NP	June 20	WI	S	LRC/Flagge	Hydrogen Zerog	P

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PART III

NASA SOUNDING ROCKET FLIGHTS (Cont.)

NASA NO.	FIRING DATE	FIRING SITE	FIRING PERF*	PRINCIPAL NASA SCIENTIST / COOPERATING INVESTIGATOR	EXPERIMENT	RESULTS*
4.47 NP	July 10	WI	S	JPL/Brown	Radar	X
4.27 NP	Nov. 18	WI	S	LRC/Corpas	Hydrogen Zerog	S
	1963					
4.66 NP	May 14	WI	S	LRC/Kinard	Paraglider	X
4.28 NP	June 19	WI	S	LRC/Corpas	Hydrogen Zerog	P
4.32 NP	Sep. 11	WI	S	LRC/Corpas	Hydrogen Zerog	S
	1964					
4.67 NP	June 10	WI	S	LRC/Kinard	Paraglider	S
	1962					
4.71 UP	June 29	WI	S	JHU/Depew	Airglow	S
4.72 UP	29	WI	S	JHU/Depew	Airglow	S
				TEST AND SUPPORT		
	1959					
2.01 GT	May 14	WI	X	Medrow	Rocket Test	S
2.02 GT	15	WI	X	Medrow	Rocket Test	S
2.03 GT	15	WI	X	Medrow	Rocket Test	X
2.04 GT	Aug. 7	WI	X	Medrow	Rocket Test	X
2.05 GT	7	WI	X	Medrow	Rocket Test	X
2.06 GT	7	WI	X	Medrow	Rocket Test	S
8.01 GT	Dec. 22	WI	S	GSFC/NRL/DRTE	X248 Vibration Test	S
	1960					
8.02 GT	Jan. 26	WI	S	GSFC/NRL/DRTE	X248 Vibration Test	S
4.01 GT	Feb. 16	WI	X	Medrow	Rocket Test	X
4.12 GT	Mar. 25	WI	S	Medrow	Rocket Test	S
4.10 GT	April 23	WI	S	Medrow	Rocket Test	S
5.01 GT	July 22	WI	S	Sorgnit	Rocket Test	S
3.28 GT	Aug. 9	WI	S	Sorgnit	Rocket Test	S
5.02 GT	Oct. 18	WI	S	Sorgnit	Rocket Test	S
3.29 GT	Nov. 3	WI	S	Sorgnit	Rocket Test	S
	1961					
3.36 GT	Jan. 17	WI	S	Sorgnit	Rocket Test	S
5.03 GT	19	WI	X	Sorgnit	Rocket Test	P
10.49 GT	Mar. 15	WI	S	Sorgnit	Cajun Fin Test	S
4.19 GT	April 14	WI	S	Russell	Attitude Control	P
12.01 GT	May 2	WI	S	U/M-Spencer	Cone Test	S
14.01 GT	25	WI	S	Sorgnit	Rocket Test	S
4.20 GT	June 26	WI	S	Russell	Attitude Control	P
14.02 GT	Aug. 16	WI	S	Sorgnit	Rocket Test	S
	1962					
4.68 GT	Jan. 13	WI	S	Russell	Attitude Control	S
10.69 GT	Mar. 1	WI	X	Donn	Water Launch	S
10.70 GT	May 2	WI	S	Donn	Water Launch	S
4.48 GT	May 25	WI	S	Pressly	Sea Recovery	S
4.60 GT	Aug. 8	WI	P	Russell	Attitude Control	P
	1963					
16.01 GT	April 8	WI	X	Sorgnit	ACS Test	X
4.87 GT	June 17	WI	S	Russell	Attitude Control	S
14.111 GT	Oct. 31	WI	S	Williams	Vibration Test	S

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PART III

NASA SOUNDING ROCKET FLIGHTS (Cont.)

NASA NO.	FIRING			PRINCIPAL NASA SCIENTIST / COOPERATING INVESTIGATOR	EXPERIMENT	RESULTS*
	DATE	SITE	PERF*			
	1964					
4.88 GT	Jan. 28	WI	S	Russell	Attitude Control	S
14.28 GT	Feb. 12	WI	S	Sorgnit	Rocket Fin Test	S
12.03 GT	April 15	WI	S	Guidotti	Rocket Test	S
4.13 GT	Sep. 26	WI	S	Busse	Rocket Test	S
16.02 GT	Oct. 21	WI	S	Sorgnit	Rocket Test	S
12.02 GT	Dec. 11	WI	S	Lane	Rocket Test	S

NUMBER OF VEHICLES FIRED 1959 – 1963

AEROBEE 100	14
ARCON	6
NIKE ASP	27
AEROBEE 150	20
AEROBEE 150A	53
IRIS	4
AEROBEE 300/300A	8
JAVELIN	18
SKYLARK	4
NIKE CAJUN	104
JOURNEYMAN	5
SPECIAL	1
NIKE APACHE	52
ASTROBEE 1500	1

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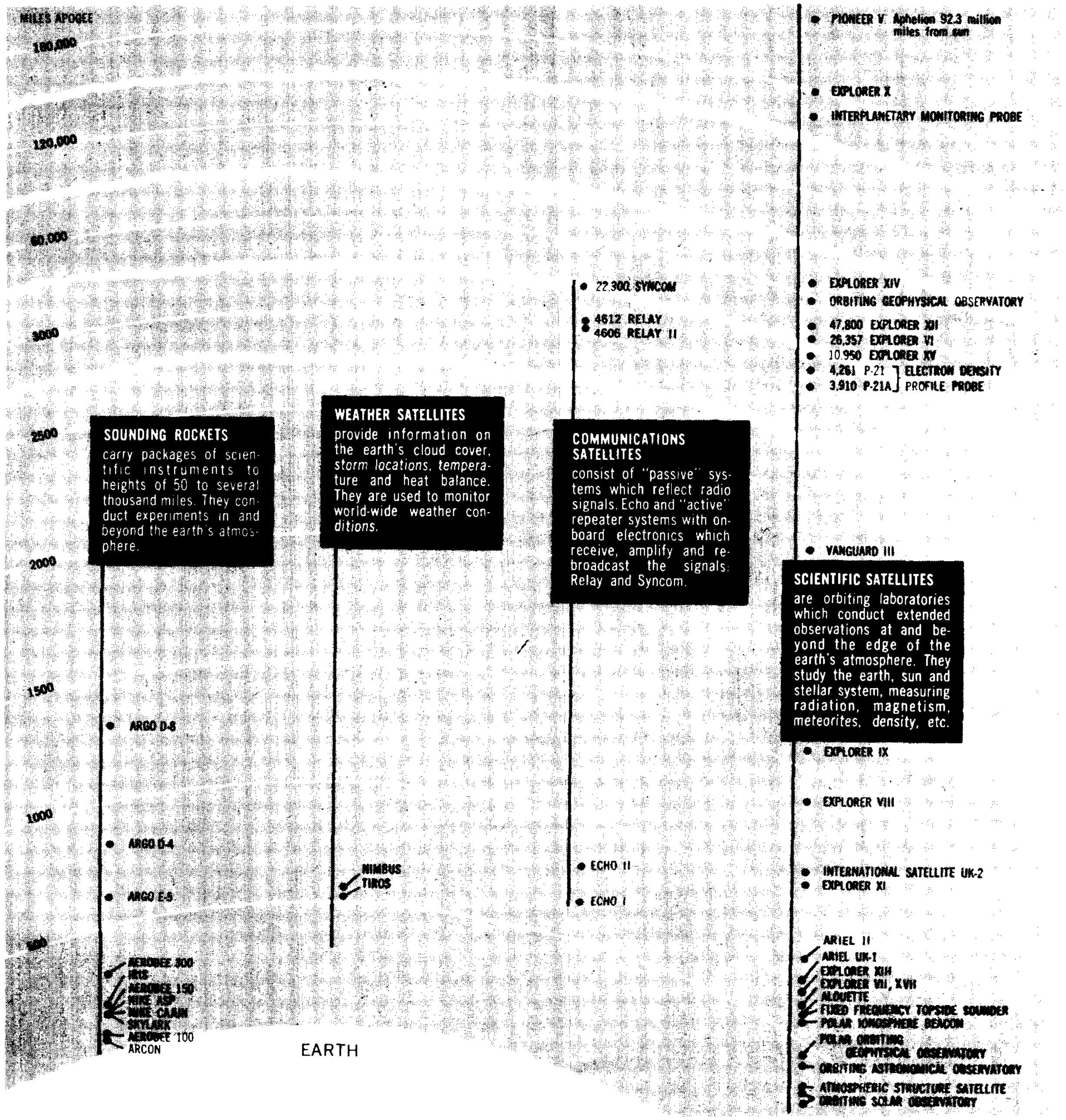
P–Partial Success } – – Subject to Interpretation
X–Unsuccessful


MILES APOGEE
180,000
120,000
60,000
3000
2500
2000
1500
1000
500
SOUNDING ROCKETS
carry packages of scientific instruments to heights of 50 to several thousand miles. They conduct experiments in and beyond the earth's atmosphere.
ARGO D-8
ARGO D-4
ARGO E-5
AEROBEE 300
IRIS
AEROBEE 150
NIKE ASP
NIKE CAJUN
SKYLARK
AEROBEE 100
ARCON
WEATHER SATELLITES
provide information on the earth's cloud cover, storm locations, temperature and heat balance. They are used to monitor world-wide weather conditions.
NIMBUS
TIROS
EARTH
22,300 SYNCOM
4612 RELAY
4606 RELAY II
COMMUNICATIONS SATELLITES
consist of "passive" systems which reflect radio signals, Echo and "active" repeater systems with on-board electronics which receive, amplify and re-broadcast the signals: Relay and Syncom.
ECHO II
ECHO I
PIONEER V Aphelion 92.3 million miles from sun
EXPLORER X
INTERPLANETARY MONITORING PROBE
EXPLORER XIV
ORBITING GEOPHYSICAL OBSERVATORY
47,800 EXPLORER XII
26,357 EXPLORER VI
10,950 EXPLORER XV
4,261 P-21
3,910 P-21A
ELECTRON DENSITY PROFILE PROBE
VANGUARD III
SCIENTIFIC SATELLITES
are orbiting laboratories which conduct extended observations at and beyond the edge of the earth's atmosphere. They study the earth, sun and stellar system, measuring radiation, magnetism, meteorites, density, etc.
EXPLORER IX
EXPLORER VIII
INTERNATIONAL SATELLITE UK-2
EXPLORER XI
ARIEL II
ARIEL UK-1
EXPLORER XIII
EXPLORER VII, XVII
ALOUETTE
FIXED FREQUENCY TOPSIDE SOUNDER
POLAR IONOSPHERE BEACON
POLAR ORBITING GEOPHYSICAL OBSERVATORY
ORBITING ASTRONOMICAL OBSERVATORY
ATMOSPHERIC STRUCTURE SATELLITE
ORBITING SOLAR OBSERVATORY